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NATURAL HISTORY

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VOLUME LIV

1945

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An Indian carving
excavated in Indiana

anuary **NATURAL HISTORY** *1945*

land Contrasts · Carr: Gray Foxes · Winter Scene

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INDIA

We regret that we were unable to supply all the many people who wrote in for the Padang Buckles advertised in the November issue. This was due to the limited number and the fact that over 100 people wrote in during the first three days.

However, we are able to compensate for the disappointment by offering the beautiful Elephant bells in the photograph. These handsome, reverberant bells from India, with baroque, clawlike design, may be used as service bells or as decorative pieces, and, best of all, THERE IS AN AMPLE SUPPLY. We do not feel we need say more—the photograph tells the story.

3″x3½″	$ 4.50
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6″x5½″	20.00

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By George B. Cressey

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INDIA AGAINST THE STORM

By Post Wheeler

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An informative book describing the country's cities and villages, races, origins, customs, creeds, and racial and religious hatreds. Well-balanced reading.

The BOOK SHOP

THE AMERICAN MUSEUM OF NATURAL HISTORY
77th STREET AND CENTRAL PARK WEST, NEW YORK 24, N. Y.

LETTERS

Sirs:

I am stationed in the Pacific area, and on my liberties I try to see and study as many of the birds, animals, and plants as I can here. These interests enhance the enjoyment of reading Natural History Magazine.

When reading the very interesting article entitled "The Modern Nature Faker," by William Carr, I noticed that you offer to answer questions on natural history subjects.

My wife recently sent me a newspaper clipping telling how a child in Asbury Park was threatened with having its eyes pecked out by a crow. I have never heard of a crow performing like that and, being interested in birds, would like to know if you can offer any explanation.

Clarence R. Johnson.

The newspaper item referred to, concerning the crow that attacked the children in Asbury Park, is interesting. The explanation for the occurrence may lie in either of two directions. Possibly the crow was a tame one which was in a mischievous mood and was playing a little roughly. When crows are brought up in familiar association with people, they often show considerable activity directed toward their human associates, pulling their hair, picking at buttons, and generally making a nuisance of themselves. Perhaps it was attracted by the bright eyes of the children. Other birds, of which the crow's near relative, the magpie, is one, have been known to show this predilection.

On the other hand, crows have been reported, how authentically it is difficult to prove, to have attacked lambs by picking at their eyes. This, however, is likely to have been in an open field. The fact that the children were "attacked" near their homes strongly suggests that the crow culprit was quite used to being around people. A wild one would have been wary. If the crow was someone's pet, the owner probably hesitated to announce the fact after damage was reported.

John T. Zimmer,
Curator, Department of Birds,
The American Museum
of Natural History

* * *

Sirs:

. . . I would like to take this opportunity to express my deep appreciation and the enjoyment derived in receiving your always fascinating magazine. Year by year Natural History maintains its high standard. . . .

I think that the editorial staff deserves a great deal of praise for the way they are keeping Natural History on its high level during war-time restrictions.

Dorothy Macneil.
Framingham, Mass.

* * *

I wish to express my appreciation for the past year's subscription to Natural History Magazine. I received the greatest possible pleasure from it, and in my estimation it is one of the finest magazines of its kind in the world. . . .

William M. Sommerville.
Toronto, Ontario.

* * *

Sirs:

. . . May I take this opportunity to express my appreciation of long standing for Natural History Magazine. It has been the outstanding magazine for use as supplementary reading in our biology classes. Articles are timely and always seem to be in keeping with matters of current biological interest.

It has seemed impossible that you have received so many letters from readers in recent years proclaiming that they had just been introduced to Natural History. How have biology teachers missed such valuable reading? . . .

The series of articles on "Strategic Plants" during the past year have been particularly useful to emphasize the importance of plant knowledge in relation to the successful prosecution of the war. A greater knowledge of the value of strategic plants may save us from such colossal blunders as complete dependence upon materials like rubber, quinine, Manila hemp, etc., without careful attention to the economic control over such necessities. The peace-time obligation for guarding these plant interests is surely immense.

A number of publications are used as supplementary reading in our biology classes. In thirteen years of classroom use, Natural History stands at the head of the list for interest, stimulation, and admiration.

Howard H. Michaud.
Fort Wayne, Ind.

* * *

Sirs:

We, too, appreciate hearing from you. Your Magazine, in these war-torn times, is a monthly reminder that somewhere men still hold high those arts and sciences to which we hope to return when peace comes again to this world.

Lieutenant S. Finkelstein.

Continued on page 44

Portrait of a young deer: a photograph taken near a camp on Penfield Mountain in western central Pennsylvania, by Thomas E. Rougeux

Q· How many ways can you build a globe?

A· As many as you please—provided the parts fit!

The communication system which carries your voice across a continent and beyond, works because its millions of interlocking parts are engineered to fit. There are thousands of switchboards, 26 million telephone instruments and 65 million miles of circuits. Each individual part, no matter how ingenious, is merely a unit in the whole system. The final test is—does the system work? This is the engineering ideal of Bell Telephone Laboratories. It has helped to create the greatest telephone system in the world.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President — ALBERT E. PARR, Director

VOLUME LIV—No. 1 ★ ★ ★ ★ **JANUARY, 1945**

A Rare Indian Carving...Cover Design

From a Kodachrome by Glenn A. Black of a figure excavated in southwestern Indiana

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THE COVER THIS MONTH

The extraordinary carving reproduced on the cover of this issue comes from Glenn A. Black, Director of Archaeology at the Indiana Historical Society. It was excavated in the Angel Mounds Group in Vanderburgh County, southwestern Indiana, and is one of the rarest specimens of aboriginal art from this section of North America.

The image, almost eight inches high, is carved in yellowish fluorite and is without a flaw. The posture of the figure may have cultural significance, for it is duplicated in several of the comparatively few images of this type that have been found.

The carving had been deposited in an upright position, facing directly east, in the Temple Mound. It was found at the southeast corner of the flattened apex of the mound and was unaccompanied by other objects. Figures of this general sort were observed by Europeans at an early date in the Temples of the Natchez and Taensa Indians of the lower Mississippi.

Explorations by the Indiana Historical Society were terminated soon after December 7, 1941. However, during three years of intensive work prior to that time, numerous interesting archaeological discoveries were made at this site, in a section of the country which the layman is not apt to think of as being archaeologically important. Many features connecting this site with the high culture areas of southeastern United States were revealed.

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Gray Fox Adventures

▲ Grace, beauty of form, and alertness mark every move of our native Gray Fox

By WILLIAM H. CARR

Director of the Bear Mountain Trailside Museums and Associate Curator, The American Museum of Natural History

THE Gray Fox of our Eastern woodlands is an intelligent animal with all the grace, speed, and cunning one could wish. His swift, shadowy form is sometimes seen by motorists, particularly in State and National Parks, where he enjoys some measure of protection. Rocky woodlands and forest borders are made to order for this bushy-tailed cousin of the larger Red Fox. The ability to climb trees is not the least of his accomplishments. More than one hiker along tree-lined trails has been startled to see the form of a dog-like animal crouching low on a large branch, often as high as 20 feet from the ground. Few realize that the creature is a fox.

We once had a partially tame gray fox which escaped in midwinter and on being pursued, climbed high up into a huge White Pine. In order to capture him one of us scaled the tree, cornered the creature on a branch, and shook him off into a large snowdrift, where it was possible to grasp him and place him in a box. If the fox had continued to run instead of resorting to tree climbing, we would

Tracy was a gentle pet; Ricky escaped but knew a good thing when he had it; but Louie kicked over the traces.

never have been able to overtake him.

Perhaps the gray fox is best observed when actively hunting in an open field. His actions remind one of a large cat. He stalks along with stomach close to the ground, ears pointed forward, and every muscle seemingly on the alert. When some luckless field mouse is discovered, the hunter will pounce with lightning speed, grasp the mouse in his long, slender mouth—and that is that! If the mouse is hidden in some grass-covered runway and the fox suspects its presence, he will stand motionless, often with one forepaw raised, waiting for the mouse to appear or to make some sort of false move which will instantly spell the rodent's undoing.

On one occasion we observed a gray fox in his watchful-waiting pose, for a space of 20 minutes. He was a perfect statue during all of his patient vigil. At the end, he sprang upward and forward but somehow contrived to miss his prey. He loped away with never a backward look, but gave his tail several spasmodic jerks as though to express his chagrin.

We have had numerous opportunities at Bear Mountain Park to watch the gray fox in his native surroundings, but our greatest intimacy with him has come about through acquaintance with tame ones we have reared in capitivity and semi-captivity. Most of our fox pets have been captured when very young and presented to us. Some of our own efforts to secure young ones have not always met with success, even though the animals had been previously caught and confined. We once received a call from a farmer friend to collect four half-grown gray foxes that he had caught in a barrel. The barrel had been placed in the loft of his barn for reasons unknown to us, and he feared the animals would escape before we could come. We made all haste and arrived out of breath with our transportation cages ready. The farmer talked to us awhile before leading us to the barn. He told of his

▲ Jane Hall Cutler plays with Louie and has no fear of his sharp little teeth

All photographs from Palisades Interstate Park Commission by Harold K. Whitford

▼ Tracy squints and flattens his ears to face a cold, biting wind

experiences in capturing the young animals. They were found in his hen yard, and he was able to place the barrel over the only exit and drive them into it.

As we approached the barn, we heard the farmer's young son give a cry, and the next instant four little foxes, one behind the other, leaped from the hay loft to the barn floor and ran at full speed out through the open door to the green fields beyond. They maintained their single file formation until they reached the brush-covered stone wall at the edge of the farm property, then disappeared from view. The boy, in his anxiety to view the foxes to better advantage, had inadvertently tipped over the barrel; the makeshift cover had flown off, and the animals took full advantage of the situation.

An affectionate friend

We were more fortunate with Tracy, a very small gray fox, caught in an open field by another friend. Tracy was so diminutive that we despaired of ever raising him to adult foxhood. He was as shy as could be and seemed to prefer hiding his head under one's arm-pit to accepting warm milk from a frequently proffered bottle. He caught on after a while and not only accepted but demanded to be fed. He proved a gentle, thoroughly satisfactory pet, trotting about after his human friends and running to them with a devotion which was both comical and delightful.

When Tracy reached the age of about eight months, any bird that had the temerity to fly through his cage, usually never lived to fly again. Tracy would leap into the air. There would be a snap of jaw upon jaw, and the bird would disappear permanently. The victims were usually English sparrows that slipped through the wire mesh to pilfer food. Chipmunks also met an untimely end when they wandered into Tracy's range. He had another unfortunate habit with unsuspecting dogs. When the domestic animals became too curious and placed their noses through the mesh, the fox, with the speed of lightning, would dash to the wire and neatly nip the dogs before they could beat a retreat. The sign near their enclosure read, "No Dogs Allowed." One visitor suggested that perhaps Tracy could read and the dogs could not. In any event, we felt sorry for the dogs, even though the responsibility for their well-being fell squarely upon the shoulders of their owners.

Home life preferred

Ricky was another gray fox which stayed in his roomy enclosure for three years and then, one day, decided to investigate new pastures. Employing his expert, sharp-toed forepaws, he excavated a neat hole where we were certain no hole could be dug, and escaped into the outer world. But Ricky did not go away. Not far off was a lovely fern garden, complete with running brook and shady paths. At one end of the fernery was a tangle of young hemlock trees, viburnums, and other plants. In the center of this green tangle was a large, gray rock, and there in the sunshine on the day after his departure, we found Ricky, curled up and sound asleep.

The fox glanced at us with an air of complete indifference, wrapped his tail more closely about him, yawned, and resumed his slumber. Two red foxes that had been Ricky's companions for a long time and seemed fairly tame, had escaped with the little gray fox. We never saw them again. It was apparent that Ricky had decided to remain near the source of supplies. The fernery was a nice sheltered place, and so he stayed. We could have captured him very easily and brought him back, but we preferred to permit him to return to the wild, in his own leisurely fashion. In truth, we were curious to learn just how long he would remain with us.

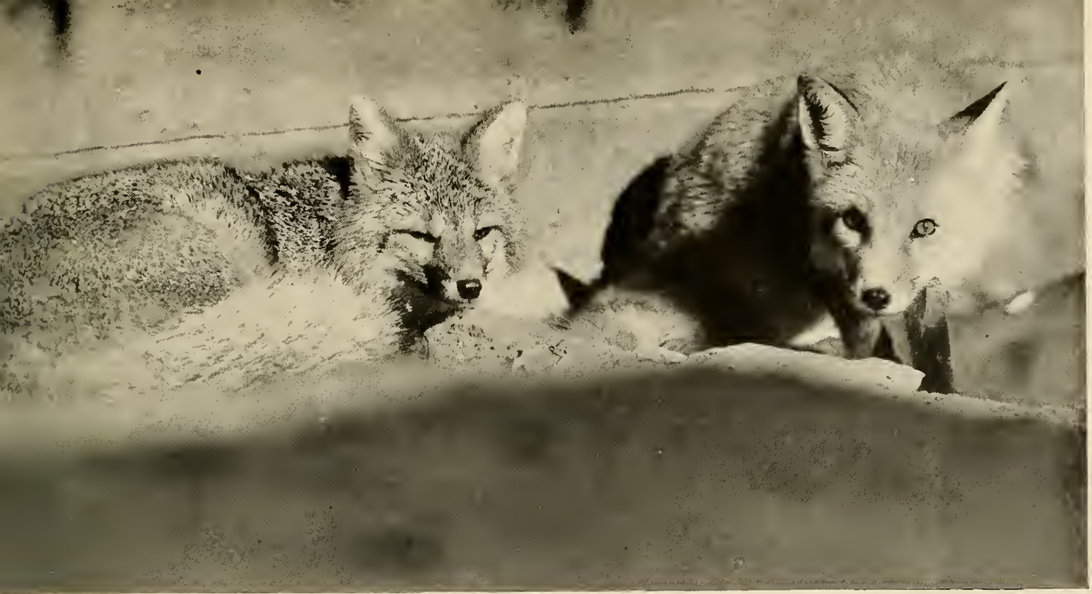
Each day, at his regular midafternoon feeding hour, we placed food upon his favorite rock, and we usually found him lying near-by waiting for us. He showed no hesitation in taking food from our fingers. His habits were so predictable that we prevailed upon one of the large news reel companies to visit us and make motion pictures of the fox in its chosen home. The cameramen came, and true to our promises, Ricky performed beautifully. He permitted the cameras to grind away while he lay upon his rock. He wandered off into the underbrush and promptly returned to be fed and, for an extra special treat, climbed into his caretaker's lap and removed a piece of food from the man's lips as he had learned to do in his days of confinement. As a result, his picture was viewed by thousands of people from coast to coast and Ricky became famous as "The Fox Which Would Not Run Away."

Weeks went by and Ricky continued to make his personal appearances. Many persons came to see him, and few were disappointed. As fall came, however, his visits to the fernery rock became less frequent and then, one afternoon, we went to see him and could not discover him anywhere. We had about decided that he had left us forever and were sitting upon the fernery fence to rest when Ricky came slowly into view, head erect, stepping daintily as he always did. A field mouse was grasped firmly in his mouth. Ricky had learned to hunt. After this he often failed to finish the food we placed upon the rock for him. Some two months after his break for freedom, Ricky disappeared from the fernery permanently and, though we roamed the woods looking for him, we were never successful in our quest. No doubt he found an attractive gray fox of the opposite sex and took to the hills where he belonged. We hoped so, in any event.

Habits unpredictable

Our adventures with Louie, another well-liked gray fox which stayed with us for eight years, failed to terminate as peacefully or as happily. Louie, during his last days with us, proved to be a Jekyll and Hyde among foxes. He had been raised as a household pet in a hospitable Connecticut home. The companion of his bottle-fed infancy was a very clever and gentle Dachshund. The two slept and played together and enjoyed the best of good times as long as Louie remained in the neighborhood. It would seem that Louie's early introduction to dogs might well have established a friendly regard for them in later life, but such was not the case, as future events proved. His friendship for people, especially women, never slackened. He was ever ready to play and to be fed by hand throughout all but a few hours of the time he lived with us.

Louie also had a pair of red foxes as cage companions. He got on with them famously and, during the winter months the three graceful animals would sleep in a warm group, body to body, snug in their little house. One day the red foxes escaped through a door carelessly left open, but Louie did not follow. In fact, that same door was left open on several occasions and Louie failed to take advantage of his opportunities to gain freedom. Children could play with him by the

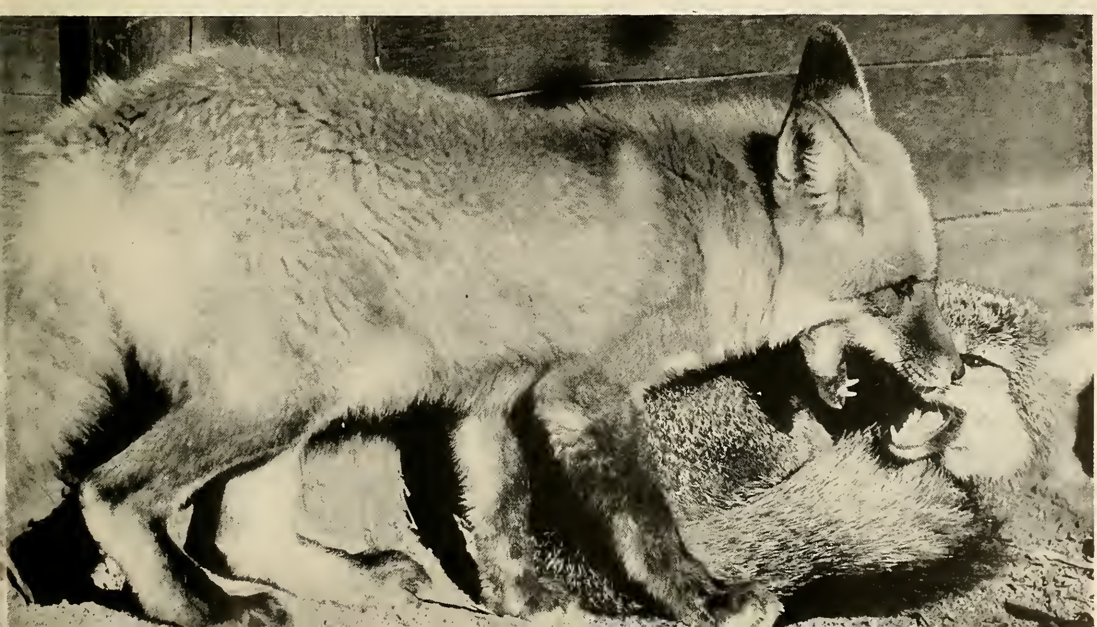


▲ Louie was far tamer than his Red Fox companions. When they escaped, he remained

hour. He would permit people to place their hands in his mouth and, puppy fashion, would pretend to bite, but his sharp teeth never once pierced flesh. When his previous owners would visit him, years after his departure from their home, Louie never failed to recognize them. He would instantly run to the wire and leap about excitedly until his old friends entered his enclosure and fed him tidbits. Incidentally, he was decidedly interested in his "foster parents," whether they brought food or not. The women of the house, as usual, were his favorites, and no one could have received a better greeting than they.

For eight years Louie continued to be one of the star boarders among many tame animals. But he finally kicked over the traces, and his exploits thereafter led to his swift but certain undoing. It all happened while we were resting on the porch one warm July night.

Our two dogs were stretched out on the flagstone floor, enjoying a soft south breeze which came up from the valley to add the final touch to the peace and contentment of the scene.



▼ The two species of fox were good friends. They played together like puppies

Our regular bedtime had come and gone, but we were reluctant to leave the cool, screened verandah. Suddenly the spell was broken. The dogs jumped to their feet and commenced to rush back and forth and up and down along the screen wall. Both animals behaved exactly as though they were in pursuit of rabbits and not far from their quarry, either. The only sound they made was an excited panting. It was very dark, and we could see nothing but the speeding, shadowy white forms of the dogs. Annoyed at the unexpected interruption of our near-slumbers, we scolded the dogs and ordered them to lie down, but to no avail.

The unexpected comes

As we peered at the near-by screen, we saw an indistinct gray form slip rapidly by on the outside of the porch. The dogs were in hot pursuit. We turned on the porch light and quickly discovered tht the wraith was none other than Louie. He had left his cage at last. At first we could not discover what governed his strange behavior.

The pacing back and forth on both sides of the screen continued for some time. We simply could not prevail upon the trio to stop it. Finally we managed to drive the dogs inside and close the door upon them. Almost at once the fox disappeared and there were signs of commotion at the back entrance, for Louie had raced around the house and was facing the dogs through the screen door. It was fully evident then that his main ambition in life was to attack the dogs. We closed the inside back door and returned to the porch. There, once more, was Louie, ready for a return engagement. We felt certain that he would remain in the general neighborhood and thus could be recaptured in the morning, so we attempted to drive him away from the dogs through the judicious use of red pepper. We placed some about the edge of the screen and, with much shouting and cries of "Shoo!" we succeeded in persuading the fox to retire. The night was stifling indoors, and it was unthinkable to permit the doors to remain shut. We rested for awhile and then prepared to go to bed. Louie had not put in an appearance for some fifteen minutes, though we heard him bark several times in the distance.

Before retiring, we decided to take the dogs out for their brief evening stroll. Right there is where we made our mistake. We were careful to place the dogs on a leash. We first walked the larger dog, a strong, full-grown Dalmatian, some five feet from the back door. A flash of gray shot out of the night like a speeding arrow, and before we could so much as open our mouths, Louie was upon the dog. We had never seen any animal of the size move so fast; it was like watching a mongoose. Louie simply swarmed all over the far heavier animal, biting it on the forefeet, the hind feet, thighs, and finally on the tongue. The large dog was completely bewildered. When the fox had first approached him, the dog had wagged his tail. Then he became mystified and was totally unable to cope with the gray streak.

In the meantime, we had pulled the Dalmatian to the kitchen door and opened it, dragging the dog into the house and trying unsuccessfully all the while to drive the fox away. The one-sided battle was in full progress upon the kitchen floor. My wife dropped to her knees and attempted to grasp the fox by the scruff of the neck with the intention of pulling it bodily from the dog and throwing it outdoors. Unfortunately, she held Louie too far away from the head and he turned upon her without hesitation. He was no longer the tame little fox we had known and regarded with affection for so long. Before she courageously pushed him from the house, she had received eighteen deep bites upon her hands, arms and wrists. Any fox, or other animal for that matter, would have behaved in like manner under similar provocation.

Louie departs only for a time

By this time it was well after midnight, but we determined to secure the services of a doctor regardless, for considerable blood had been lost. Soon eighteen nitric acid cauterizations were provided for the bites. The police had been called, for the doctor insisted that Louie either be captured or slain to determine whether he had rabies. There was a rabies scare in the community at the moment. Although the errant fox barked several times, the police were unable to locate him in the cloudburst which by then had descended to add confusion to the scene. At five o'clock in the morning, however, we heard Louie's husky bark directly beneath our bedroom window. Scrambling sleepily from bed, we peered out, and there sat the pugnacious fox upon the lawn as though to issue a challenge to the dogs and to us to come out and do battle.

It was not until the following afternoon that the police located the unhappy Louie, sleeping beneath a pile of boards not far from his cage. He was quickly killed, and it was later shown that he had no rabies whatever. Before the examination was completed, however, Louie's victim was forced to undergo the injection treatment for rabies, rather than chance the risk of contracting the disease.

Actions a mystery

It was a very sad affair. We shall never be able to explain the mysterious forces that drove the doughty fox to attack the dog. Both animals were males. As far as we knew there had been no incident to provoke a feud between them. Certainly the dog showed no inclination at any time to annoy or otherwise disturb the fox. The incident was prompted by a strange quirk that will forever remain a secret to us. The attending physician's only explanation was that the fox must have gone berserk, and this official reasoning provided us with no choice but to follow his instructions to the letter. On the other hand, we knew Louie very well indeed and were certain that he was a perfectly sound fox, despite his impulse to commit mayhem upon our dog.

Numerous and varied were the thoughts offered by many persons in a futile attempt to explain the motives that prompted Louie's unaccountable behavior. An experienced fox hunter suggested that a red fox would never have acted in this fashion, thanks to its superior intelligence. We have insufficient knowledge to accept or deny this conclusion. We have raised a number of each species and we would hesitate to say which one possessed the higher I.Q. They are intelligent in different as well as in similar ways. Our own powers of comprehension are tremendously limited when it comes to interpreting or determining the relative intelligence of animals. Of one thing we are certain. If we had stirred ourselves and captured Louie when he first appeared beside our porch screen, he would be alive today and his empty cage would not confront us whenever we walk by.

^ Ricky gained freedom but stayed in the neighborhood. John Kenny feeds him in the open

^ Louis liked the ladies and was quite a lap fox, as Valentine Van Weelden discovers

˅ A study in profiles. Though the Red Foxes were larger, Louie was the "boss"

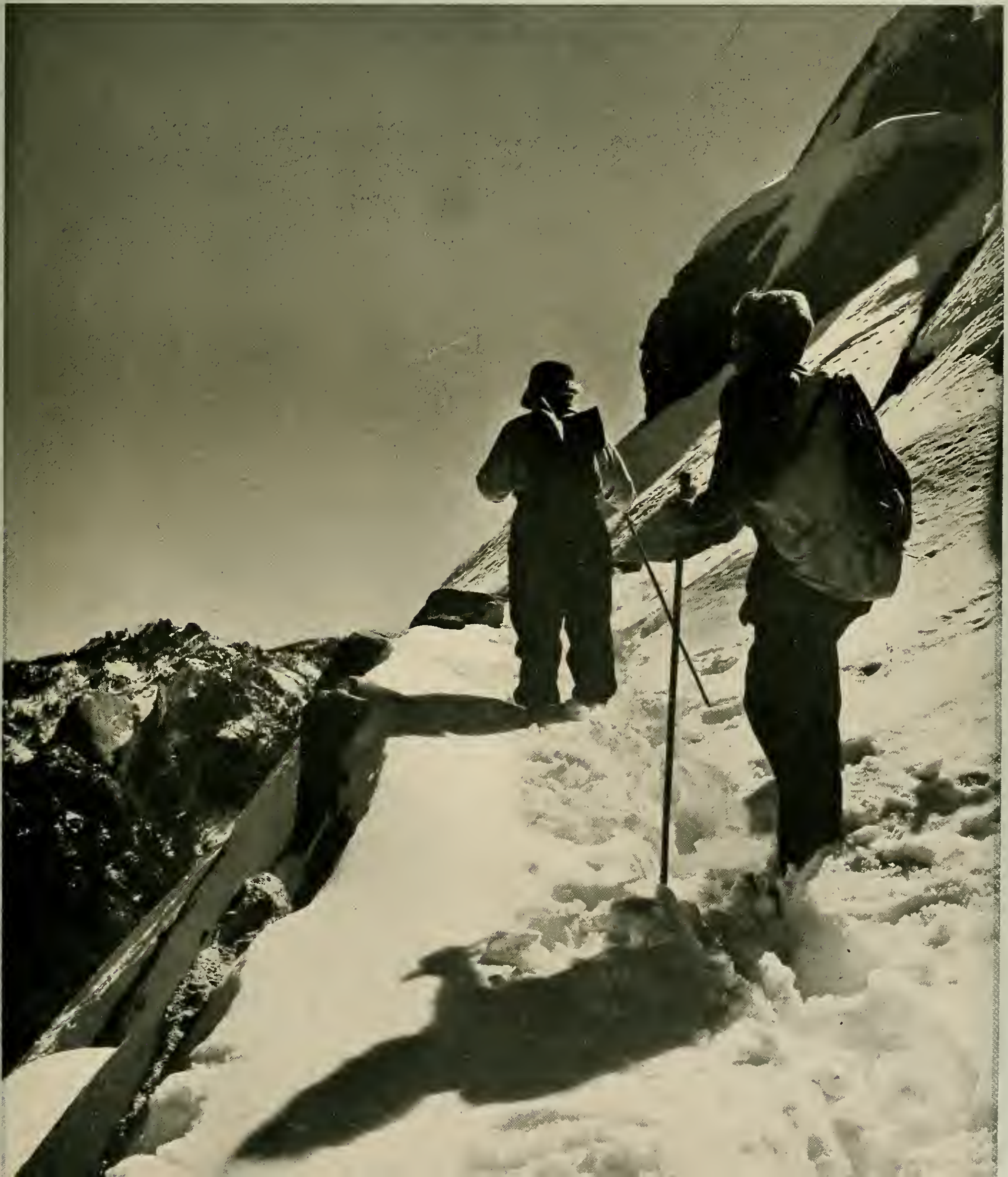
" . . . the frolic architecture of the snow"

"Beneath the crisp and wintry carpet"

WINTER through the CAMERA'S EYE

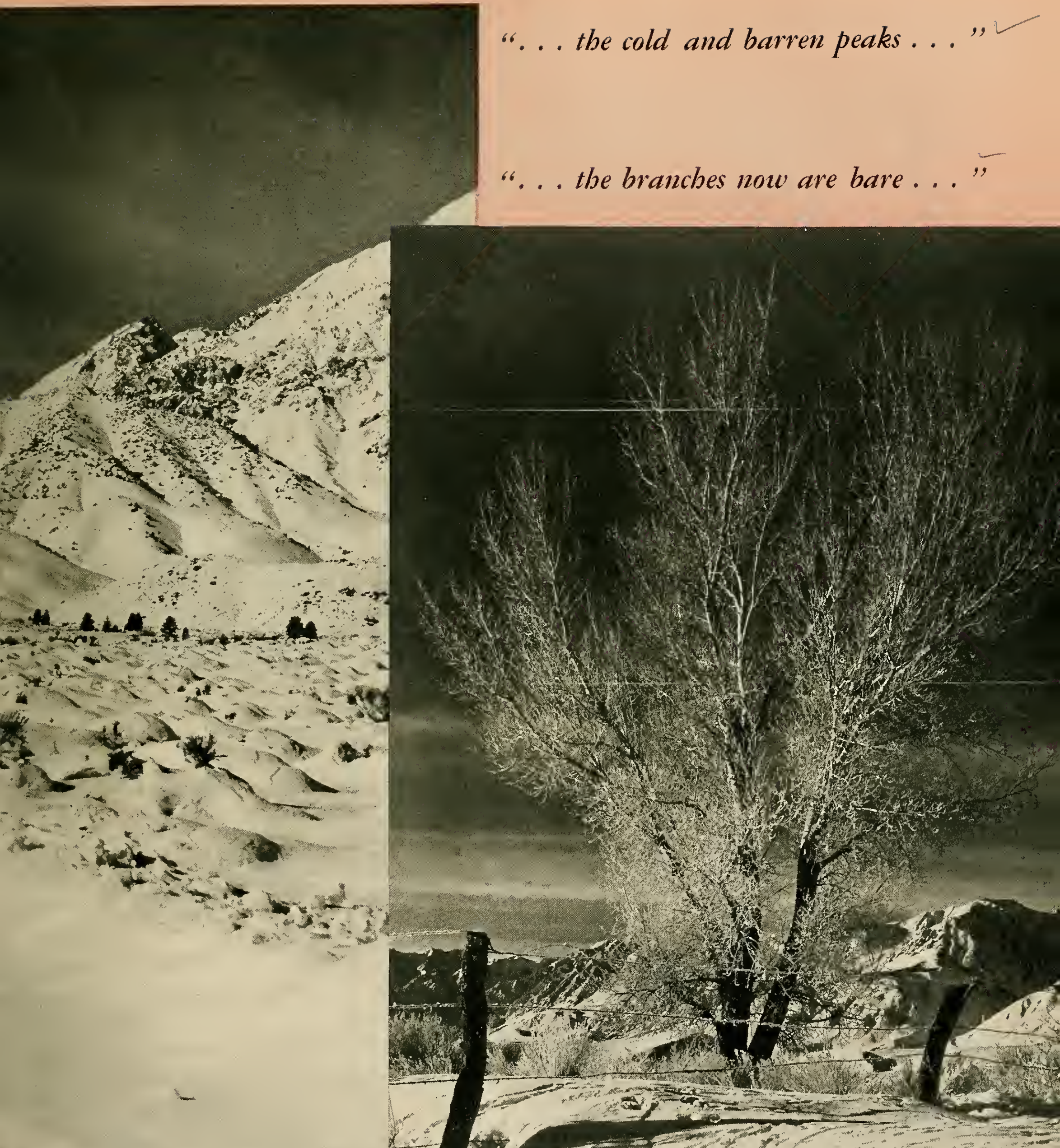
By JOSEF MUENCH

". . . Deep drifts smother the paths below . . ."



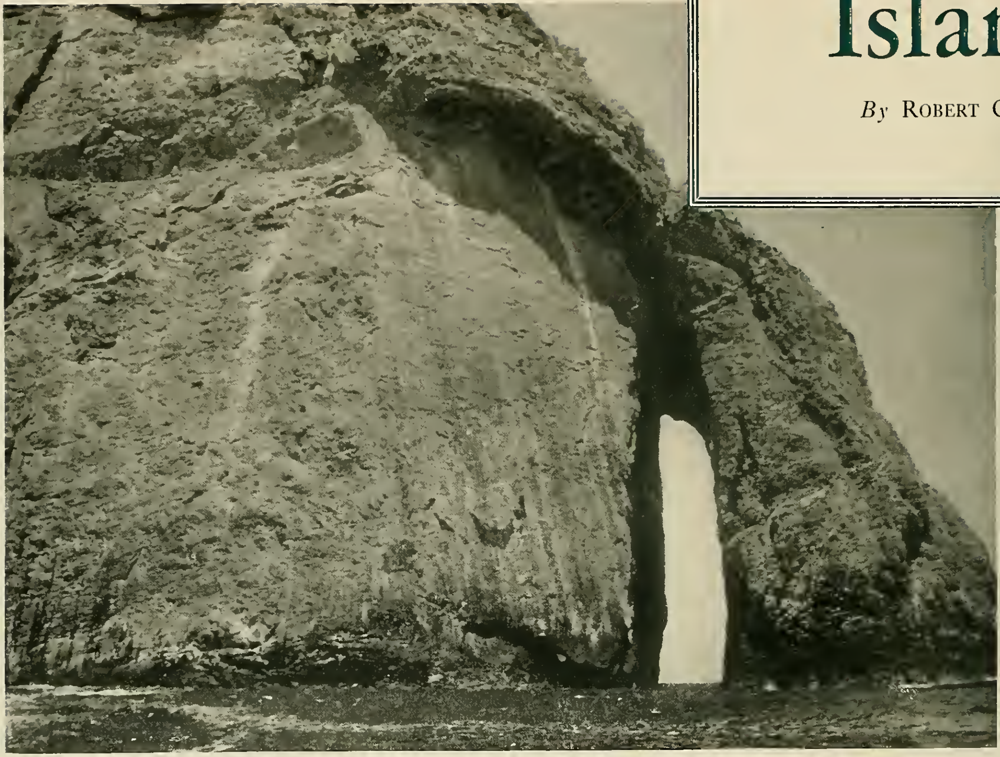
". . . the cold and barren peaks . . ."

". . . the branches now are bare . . ."



Island

By ROBERT CUSHMAN



The "Askoy" Expedition explores the fabulous Bight of Panama and its diversified islands. This is the story of three of those islands and the spectacular contrasts in their climate, vegetation, and wildlife

THIS concerns three dissimilar dots of land in the Bight of Panama. Malpelo, 250 miles west of Buenaventura and the first oceanic island in the Pacific ever sighted by Europeans, takes its name from a "bad head of hair," for it is nearly as bald as an egg.

La Plata, 15 miles off the capes of Ecuador, was discovered by Pizarro on his way toward the conquest of the Incas. Its name means "silver" or "money," and perhaps stems from the tradition that in 1578 Sir Francis Drake divided on its only beach the booty of the Spanish galleon "Cacafuego." La Plata has a stunted, xerophilous or "drought-loving" plant cover, dependent upon scanty rains.

Gorgona, 16 miles off the Colombian coast and midway between Buenaventura and Tumaco, was likewise discovered by Pizarro. Its name may have no fanciful significance whatsoever, but I like to imagine an association with the gorgons because the island, lying under the everlasting watering-pot of Chocó skies and smothered beneath equatorial rain forest, is as full of serpents as the tresses of Medusa.

Malpelo has never been inhabited, but the soil of La Plata and Gorgona harbor stone and metal relics that tell of occupation throughout centuries or millennia by long-vanished Indian populations. The names of all three islands have appeared in the record of our voyage in "Askoy," but now let us go ashore and take possession.

Malpelo

On March 25, five days out of Buenaventura, we made Malpelo, dead ahead, at eleven o'clock in the forenoon. The latitude, 4°N., was a thoroughly wet one at the continental coast, but within 24 hours we had entered "dry seas." For four days following our landfall we remained in

➤ THE EFFECT OF AN OCEAN CURRENT, as shown by the discrepancy between *course* and *track* while "Askoy" was running under motor power in calm weather on March 28.

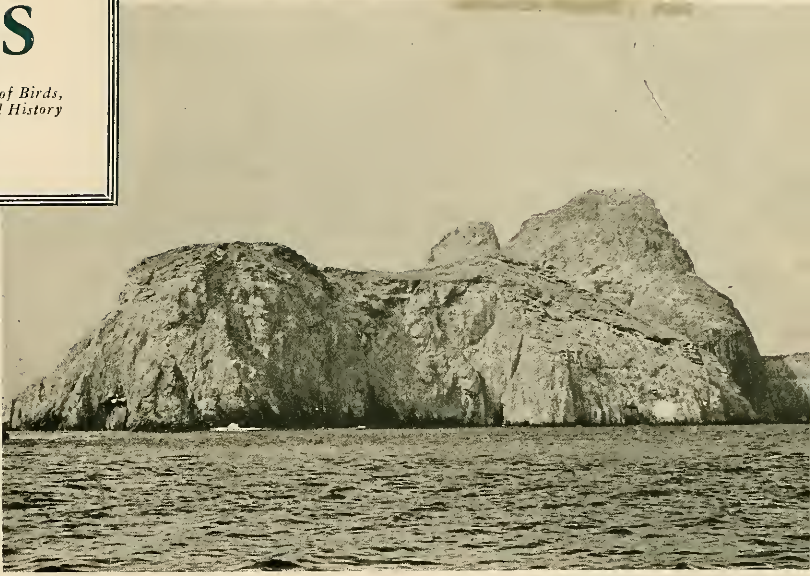
At 5:45 A.M., a navigational fix was obtained by intersection of position lines from the stars Antares and Fomalhaut. The course toward Malpelo was then 45° or northeast. At 10:30 A.M., a running fix was obtained by intersection of a position line from the sun and an advance of the earlier line from Antares. (This fix assumes a current flowing due south, though this was not necessarily the case.)

Frequent correction of the course was necessary, and Malpelo was regained along a curved track before sunset. As the course was changed, the effect of the current became more pronounced and the speed of the schooner was progressively slowed

Contrasts

URPHY
Chairman, Department of Birds,
The American Museum of Natural History

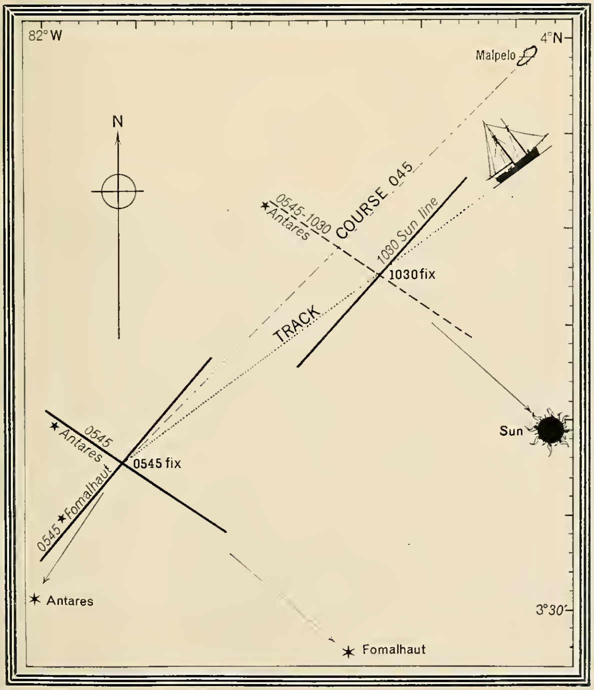
‹ Looking through an arch arved by the sea from a cove on he southeasterly side of Malpelo sland



➤ Malpelo from due south, showing the high point of the island and the tip of the Column on the northwest side. At the extreme right is the small peninsula containing the buttressed arch

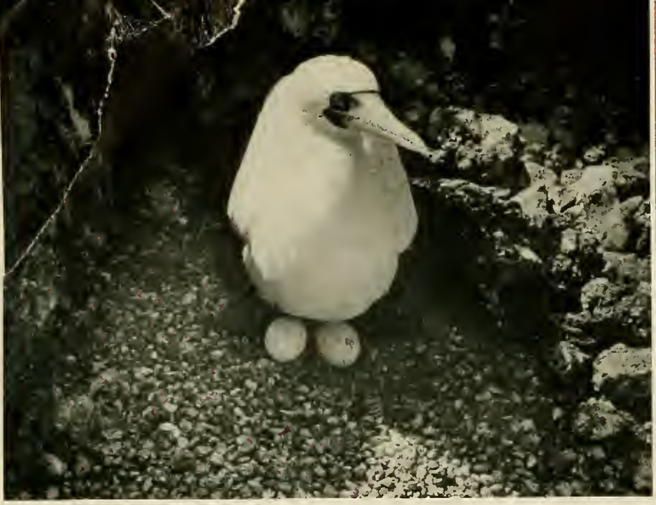
the vicinity of Malpelo, though often out of sight of the island, frustrated by strong currents in conjunction with an engine delivering far less than its specified power.

Motor speeds offer a good example of relativity. A four-knot craft, such as "Askoy" actually proved to be, may properly be called half as fast as an eight-knot craft, but the ratio changes as soon as both vessels begin to buck a current. Around Malpelo we encountered a surface current from between north and northwest which attained the extraordinarily high rates of from 1.7 to more than two nautical miles per hour, or half our engine speed. I say surface current because our instruments showed that the movement was a warm overflow, not more than ten fathoms thick, and that two underlying layers had different relative directions. We ascertained the speed of the surface flow by checking our steered course against our observed track.



Malpelo proved to be the barest monolith of its size that I had ever seen. The skyline, the arches, battlements, and the caves at sea level were spectacular and fantastic. As we circled around the rock, a mile long and nearly 900 feet high, it looked from different aspects like a castle, a battleship, or a smoking volcano, the last illusion being due to misty streamers that clung to its summit. From various points of view in relation to the direction and angle of sunlight the island took on every hue between a black silhouette and the pale pink of a Maxfield Parish painting.

From shipboard, the only vegetation to be seen on the main island was made up of algae on the walls and vaults of sea caves. But one or more of the small stacks off the northern end had tufts of withered grass on the vertical flanks and a few small brown shrubs or bushes near the summit. Unfortunately, these rocks were unscalable, and we were not able to shoot off plant specimens with a Mauser rifle, so nobody yet knows the identity of the almost negligible flora.



▲ A MASKED BOOBY of Malpelo has made a mosaic pavement to serve as its nest on the plantless island

When we approached close to the island, the deeply weathered slopes and saddles were seen to be peppered with white spots, which resolved themselves into masked boobies. The birds were scattered nearly everywhere from a few yards above the foam. Never having seen more than a score of these boobies in any one locality, I had not previously realized that there were so many in the world. A rough estimate made during our stay indicated a population of about 25,000 at Malpelo, more than half of which were usually standing in pairs at the nest, while others were flying singly off to sea or returning in small wedges of nine or ten together.

Armstrong and I succeeded in landing twice on Malpelo on different days. The feat is not easy, even in calm weather, because there are only two none-too-comfortable ledges from which a man may gain the heights. We chose the bank of a swirling cove on the eastern side, where the intertidal rock was overgrown with slippery seaweed and where lacerating barnacles offered the only grip. Rubber-soled sneakers were of no avail, but bare feet proved better, even under the certainty of cuts and bruises. The first move was to lie a few yards offshore and to watch the tons of seething brine lick and bubble over the ledge, converting the cove into a boiling cauldron. Experience showed that two or three successive engulfments would be followed by a spell of quieter water during which Time might be seized by the forelock. Once up beyond the gluey mat of seaweed, you had little to worry about except the hazards of getting off again, a trial that it was best to defer until the latter part of the ebb.

On an island practically devoid of vegetation, it was somewhat surprising to find clear pools of potable water, with only a slight taste of soda. This had seeped out of the rock and collected in some of the caves and elsewhere above highwater mark. Malpelo may thus be said to have springs, even though it has almost nothing that can be called soil. It obviously suffers during most of the year from extreme drought, yet at certain seasons it receives enough rainfall to support its apology for plant life and to supply a source for the small basins of fresh water that never fail. It is reported that the altitude of Malpelo is sufficient to precipitate occasional heavy showers that fall on the ocean a mile or so to leeward, so that a vessel cutting across down wind may enter rain while the rock itself remains unsprinkled.[1]

In 1921, General Paolo Emilio Escobar published a book relating to the Pacific coast which contains certain astonishing information about Malpelo. Fortunately, the author states that he had not personally visited the island but had obtained his data second hand. At any rate, he endows it with groves of coconuts and other palms, thickets of shrubbery, and the simple but thriving gardens of resident Colombians! Turning to Comandante Fallon for an explanation of this yarn, we were assured that Malpelo had long served a legendary purpose for certain politicians in his country, which, as he rightly observed, are not very different from politicians elsewhere. What could be more appealing and dramatic in Bogotá, he continued, than an impassioned burst of oratory directed toward the succor and cultural advancement of the loyal but neglected Colombian citizens dwelling on Malpelo!

As to actual inhabitants, the first that we met ashore were crabs and lizards, of which two species of each were abundant. Red amphibious crabs (*Grapsus*) swarmed all over the rocks at sea level, and I found a large one in a crevice engaged in the cheerful occupation of eating a smaller example of its own kind. Even more ghoulish in appearance were the land crabs, fat and bloated-looking creatures with shells of a ghostly white. They may be quite harmless toward human beings, yet they seem to eye a visitor with an intent that grows uncomfortable. If you sit still long enough, the crabs will move up closer and closer, as if with whetted appetites, and I have a feeling that they would make the night miserable for anyone who had to sleep ashore.

Of the two reptiles, one is an alligator lizard, a moist-looking, fleshy brute of more or less the form and size of a Gila monster, but having a shiny dark skin covered with fine spots. The lesser species is a wall lizard, related to the so-called American chameleons. Curiously, the small species, which is not at all closely akin to the alligator lizard, is likewise covered with fine white spots. Both reptiles differ in this odd character from all their respective relatives. Both are found nowhere in the world except on this tiny rock lying in the midst of ever-restless swells.

Of the less conspicuous forms of life, we saw little during our hurried call. The reptiles, however, contained evidence which should serve as a lure to the next visiting naturalist. In the stomachs of the wall lizard we found remains of small crabs, spiders, pseudoscorpions, beetles, flies and fly larvae, ants and other insects, most of which are probably yet unknown to science.

The recorded bird population of Malpelo numbered only ten species, to which our collections added the red-billed tropic-bird. A sea fowl that we unfortunately failed to obtain was the resident man-o'-war bird. All man-o'-war birds are now known to be relatively sedentary, rarely ranging as far as 150 miles fom their nesting or roosting places ashore. Therefore, nobody yet knows what kind nests at Malpelo, nor can the problem be solved until a visitor collects at least one adult of each sex.

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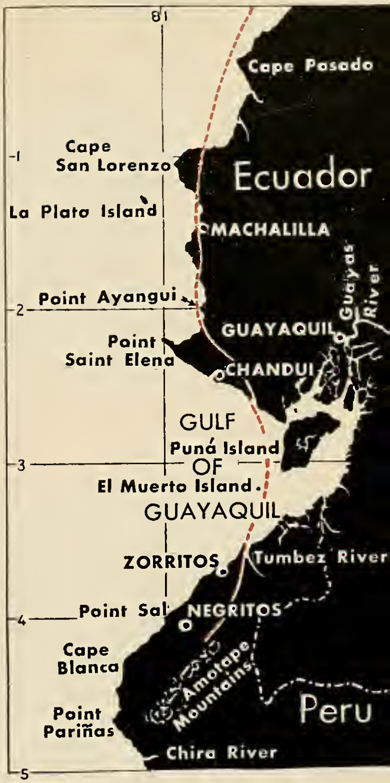
[1] A report on the rock structure of Malpelo, previously unknown, and of the phosphatization of the original volcanic material through the action of bird guano, has been published in the "Askoy" Expedition series: Duncan McConnell, Bull. Geol. Soc. of Amer., vol. 54, pp. 707-716, 2 plates.

An extraordinarily beautiful resident sea bird is the swallow-tailed gull, a species peculiar to Malpelo and the Galápagos Archipelago. The Malpelo colony is small, and I wished to collect only one or two in order to note the brilliant skin colors and to learn the nature of the birds' food. Going down alone in the skiff on March 26, I found the gulls occupying ledges and niches low over water surging against the perpendicular wall near a great green sea cave. The puzzle was how to get near them, because the wind was onshore and the wild backwash made it prudent to remain at a reasonable distance from the foot of the cliff. I finally fired my gun at the sheer rock, scaring off the whole cloud of gulls, and then it was a simple matter to drop one in a safe spot. The gorgeous bird was as large as a herring gull, but with longer wings, forked tail, and a slender bill. Its brown eyes were surprisingly large, and a hood of dark gray plumage covered the head and neck. The remainder of its feathering was a symphony of white, gray, and black. But the skin colors were the startling feature: eyelids, crimson; bill, black at base, pale blue at tip, with the angles of the mouth crimson; bare skin below the bill, salmon pink; legs and toes, peach-blossom pink, the webs geranium pink with black borders. Its stomach was crammed with rare red-and-blue swimming crabs (*Euphylax dovii*) which, to the delight of Doctor Armstrong, we had already found swarming at the surface for many miles around Malpelo.

On March 29, when a great swell from the south had made further landings impossible, we laid our course for Ecuador, unbending the trisail from the mainmast and boom-in-gallows, and rigging the mainsail for the long reach toward Manta. I said nothing to my shipmates, but I suspected that we might find that Mrs. Murphy had flown down from New York for a visit. And that was just as it turned out, when we anchored on April 4.[1]

La Plata

La Plata is associated in my mind with venomous sea snakes ringed with black and yellow bands, which infest the waters around it. In remote days, before the buccaneer William Dampier introduced the first goats, the island may have had a far more hospitable aspect than today. It is probable that the original vegetation protected the soil from the erosion that has been gullying it in recent centuries. At present it would seem that only the infrequency and briefness of the rains have prevented it from being all washed into the sea. The island lies to the west of a curious climatic line, on the eastern side of which there is a rainy season of five months' duration each year. On the offshore side of the line very slight annual rainfall comes only occasionally between January and April, if at all. About every seven years, however, the same months are marked by heavy precipitation. The time to see La Plata at its best is after the rains. This experience I have had twice, first in 1925, before the end of the deluges of that never-to-be-forgotten year, and again when "Askoy" dropped her hook on April 12, shortly after the lesser showers of 1941.

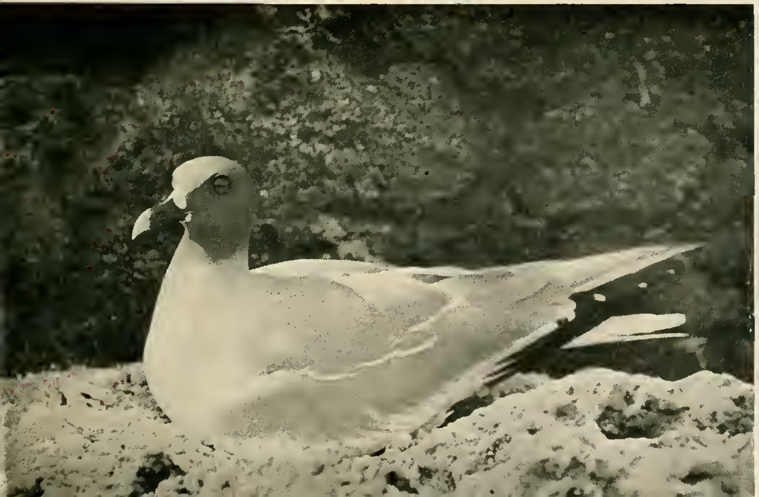


▲ THE "RAIN LINE," to the east of which there is a copious annual rainy season during the northern-hemisphere winter months. To the west, rain is scanty and is most pronounced at intervals of about seven years

Nobody lives at La Plata except a lighthouse keeper and his family, although fishermen from Manta and elsewhere sometimes make use of the small landing beach. In 1925, José Garcés was the lightkeeper who dwelt on the little plantation behind the strand. By 1941, Garcés and his numerous brood had ceased to be even a memory to his successor, Manuel Hauptmann. The latter had been in residence six years. Four of his chil-

▼ SWALLOW-TAILED GULL, one of the most beautiful of sea birds. The species nests only at Malpelo and at two or three islands of the Galápagos group

(*Photograph by Templeton Crocker Pacific Expedition*)



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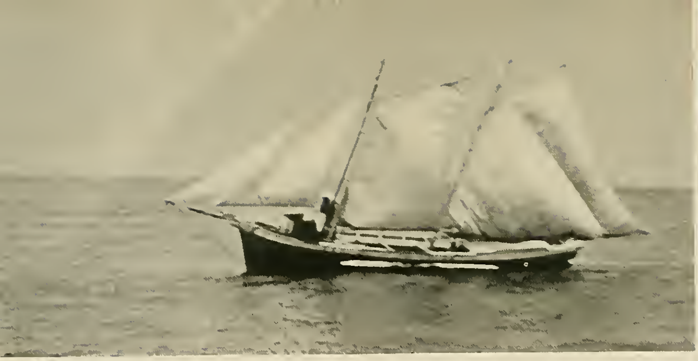
[1] Grace E. B. Murphy: "Flight to Ecuador," NATURAL HISTORY, vol. 52, 1943, pp. 62-69, 19 illustrations.



▲ **A TYPICAL DUGOUT MINIATURE SCHOONER** of the Chocó coast. The craft is less than 30 feet in length. Noteworthy are the logs of balsa wood lashed on each beam. These serve as outriggers and are sufficiently buoyant to prevent the craft from capsizing

▲ **A PEACEFUL ANCHORAGE** off Gorgona, with the fruitful island of Gorgonilla in the background. The sloop is a native Colombian merchantman from the River Charco. Over her port bow hangs a wicker chicken coop which contains a cock and six hens so that the master of the craft need never go without fresh eggs

▲ **GORGONILLA,** or "little Gorgona," lies a half-mile off the southern end of the main island. It is extremely picturesque, and parts of its coast are thinly forested so that it offers nesting sites to vast numbers of boobies and other sea fowl

dren had been born on La Plata, and the younger members of the family, including two small boys old enough to serve as our guides, had never been off. Theirs was a Crusoe existence, La Plata serving as the hub of a universe bounded on one side by an ocean horizon and on the other by the barely visible blue sierras of Ecuador.

La Plata, which is about two and a half miles long by one and a half at its greatest breadth, attains an altitude of 700 feet. The perennial vegetation comprises arborescent cacti, algarrobo, lantana, capers, and other drought-resisting woody plants. Many of the trees and shrubs have fleshy leaves or other special equipment for preventing loss of water. Many also bear long beards of Spanish moss, which the Ecuadorians call *lana salvaje*, or wild wool. One conspicuous plant among the generally stunted arboreal species is the *palo santo*, or holy tree, so-called because its twigs, when broken, weep copious aromatic drops that give off the odor of tear gas.

Such is the thickety vegetation which at all seasons combines with a rough terrain to make travel difficult away from the trails. But after the rains, be they ever so feeble, new greenery springs into life, and the ground sends forth vines, herbs, and blossoms in a profusion that soon carpets the bare, cracked surface. Gigantic white *amancaes*, or spider lilies, with golden centers, are among the first to bestar the long slopes between the central hills and the edge of the westerly cliffs. These are followed by

↘ **GORGONA** is an isle of perennial brooks, fed by rains that fall on practically every day of the year. Their beds offer the only feasible routes to the heights

morning glories, gourds, various grasses, tiny sunflowers, mallows, wild cotton, and a host of others, which combine with the caroling of mockingbirds and the aerial dance of the vermilion flycatchers to create the brief and uncertain season of spring.

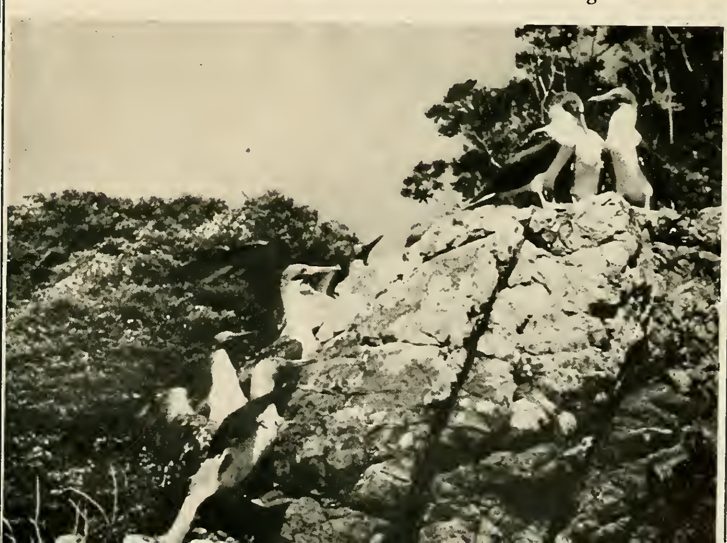
Just as I remember sea snakes in the ocean around the island, so I cannot forget the goats ashore. Many of the animals are white, and from far away you see them filing nimbly along almost nonexistent ledges on the face of the cliffs or posing statuesquely against the clouds on some knife-edged ridge. It is the goats, beyond a doubt, that began the destruction of La Plata in the seventeenth century. After they had removed much of the permanent plant cover, the rains were able to go on with the job. Oscar Paar, our engineer, following a hunt on which he shot the half-grown kid that served as the *pièce de résistance* of our Sunday dinner, remarked that there was a strong similarity between the vegetation of La Plata and that of St. Helena in the South Atlantic. At the time, he knew nothing of the fact that St. Helena was heavily forested at the date of its discovery but that it later underwent a long goatish history.

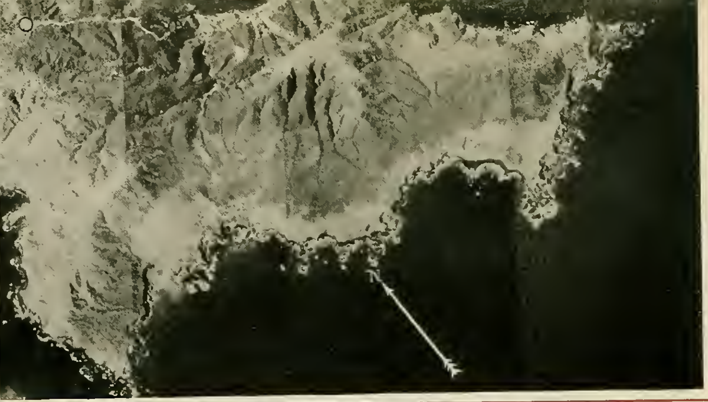
Even life under the surrounding water has probably deteriorated because of the ultimate influence of goats. We discovered, for example, extensive growths of reef corals. During diving operations with our Dunn helmet, we found that many of the masses were in a moribund and rotting state. It surprised John Armstrong, indeed, that reef corals could live at all in water containing as much suspended silt as had recently been washed off La Plata. For the same reason the pearl oysters, which were

▲ A COCAL on the eastern coast of Gorgona. The palms, the coral beach, and the thatched hut combine to make a scene suggestive of Polynesia

▲ IN MANY PLACES the riser behind the shingly shores of Gorgona is curtained with dense masses of feathery ferns

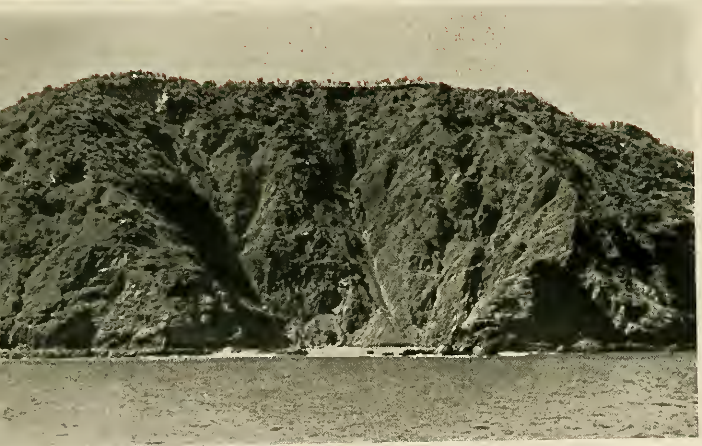
▼ BLUE-FOOTED BOOBIES, the legs and feet of which are actually the color of robins' eggs. They roost in great numbers on rocks around the shores of Gorgonilla





▲ La Plata from the air: a photograph used by courtesy of the Hydrographic Office of the U. S. Navy Department. The landing beach and buildings are in the cove on the quiet shore (upper). The foot-trails show distinctly, one of them leading through the main gorge of La Plata to the low tableland and surf-beaten cliffs of the southwesterly coast. The extraordinary erosion of recent years is evident in this picture

▲ When "Askoy" circumnavigated La Plata before dropping anchor off the landing, Comandante Fallon stood in the rigging and kept a sharp lookout for submerged rocks



▲ Knife-edge erosion of the bluff at the northwestern point of La Plata. Such destruction of soil has been brought about by the browsing of an overpopulation of goats throughout perhaps three centuries

▲ Oscar Paar, engineer of "Askoy," "brings home the bacon" in the form of a La Plata goat for the Easter dinner of a hungry crew

◀ Early visitors to La Plata freed burros so that there is today a small wild herd, including at least two stallions of a beautiful mahogany-brown color. When these mammals dashed away in a cloud of dust, the sight resembled a flight of wild asses in Asia

▶ Masked boobies on the overhang of La Plata cliffs, 90 feet above the water. The hard but friable indurated soil of the island shows well in this

formerly harvested, may have disappeared.

Our final day at La Plata was Easter. We carried on as usual, but I found it hard to concentrate because my imagination wandered to New York, where I knew that my first granddaughter was being christened, and that her grandmother had arrived home by plane from Salinas, a town lying under the very clouds that I could see piled above the Andes. All day as I looked over the lonely pampa of La Plata, or at the sea caves and spouters, the coral heads four fathoms down, the angelfish and the waterfowl, I was seeing also a blur of top hats and spring clothes along Fifth Avenue! I doubt whether the lightkeeper, the seven little Hauptmanns, or the señora to whom Fallon always referred as "the lady," knew that it was Easter, or even Sunday, but I may be wrong.

Gorgona

Dark Gorgona lies on the parallel of 3° N. latitude at about the limit of naked vision from the Chocó coast. Ever since its discovery in 1527, it seems to have aroused mixed sentiments in its visitors. The marooned Spanish conquistadors regarded it as a place of torture, a hell-on-earth. To the British buccaneers of the next century, it seemed, on the contrary, like a bit of Paradise. My own experiences during two visits would lead me to subscribe to both opinions because Gorgona lacks neither perils nor charms. It is a hot, reeking island-mountain, teeming with luxuriant life that runs the gamut from streptococcus bacteria and deadly serpents to entrancing birds and orchids.

On September 16, 1937, I first approached Gorgona in the launch "Wilpet" from the offshore side and rounded its northern end after nightfall. The ocean was black and still along the easterly shore, and also deep, because for a long while on our cautious approach we could find no bottom with the lead until we had come close enough to hear the pleasant whisper of running water and to make out dimly the gleam of a sandy beach, backed by a hut among palms. Then we dropped anchor and turned into our berths, exhausted, while frogs and cicadas lulled us to sleep.

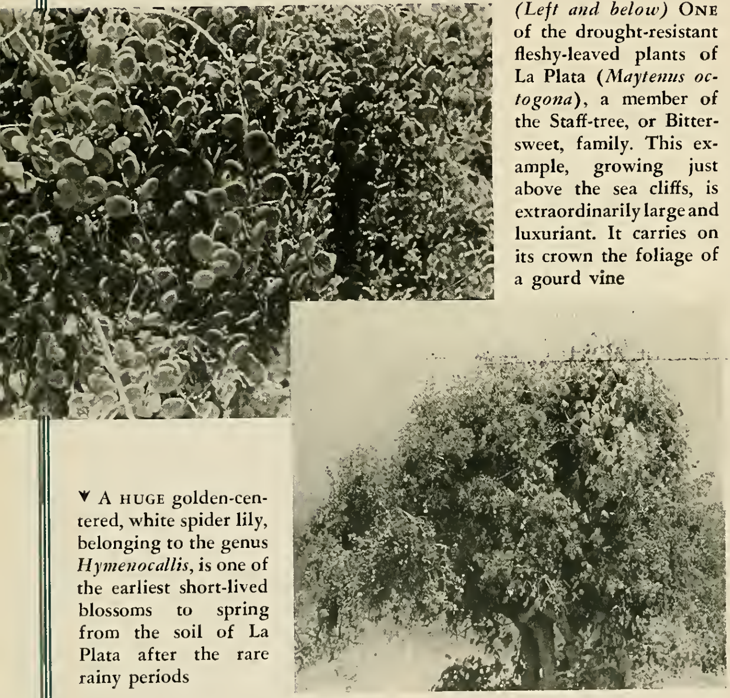
Next morning was bright and sunny, regardless of the season, which was close to the annual peak of rains. Our launch lay under the central hill of the island, toward which the forest

▲ THE AUTHOR of the "Askoy" Expedition series in NATURAL HISTORY making motion pictures of masked boobies, above the sea cliffs of La Plata, during his visit of 1925

➤ THE LANDING BEACH and only settlement on La Plata also mark the point at which an ancient river canyon enters the sea. The anchor of "Askoy" was accidentally dropped into this gorge so that, to the consternation of all hands, it descended seventeen fathoms only a moment after the sounding lead had found five fathoms

▼ CONSTRUCTION OF TEMPORARY HOMES on the coast of Gorgona is a simple matter for those who inherit the tradition of the native Chocó Indians. Foundations and beams are lashed together with withes; the flooring is of split palm, and the roof is thatched with palm fronds. Familiar tropical culture plants grow around this hut

▼ ONE of the white and distinctly unprepossessing land crabs of Malpelo. This species (*Geocarcinus planatus*) is known also from certain islands off the western coast of Mexico, which indicates that in the remote past it may have reached Malpelo from the north



(Left and below) ONE of the drought-resistant fleshy-leaved plants of La Plata (*Maytenus octogona*), a member of the Staff-tree, or Bittersweet, family. This example, growing just above the sea cliffs, is extraordinarily large and luxuriant. It carries on its crown the foliage of a gourd vine

▼ A HUGE golden-centered, white spider lily, belonging to the genus *Hymenocallis*, is one of the earliest short-lived blossoms to spring from the soil of La Plata after the rare rainy periods

crown sloped up 1200 feet, with wisps of fog hanging among the trees, the infinite shades of green accented by red patches wherever flowering vines had climbed through to daylight. The water was a clear, deep blue, and we could look down "full fathom five" upon beds of small staghorn coral over which brightly colored reef fishes were moving.

The skipper and I were soon ashore among the *cocales* and their palm houses, which we found filled with all the gear of absent inhabitants. This included balsa outriggers, fish lines and nets, stone anchors and mortars, fireplace pottery, kitchen utensils made of gourds and coconut shells, sandals of both hide and wood, and similar personal effects. Beds of coconuts had been laid out here and there to sprout for subsequent planting. There were also small banana hedges and blooms of red hibiscus and other flowers. Each of several such empty settlements was behind a sand and coral beach, separated from the next one by shores covered with blocks of porphyry, across which walking proved exceedingly difficult. The vertical riser behind such rocky stretches was topped and overhung by dense forest, or curtained with enormous feathery masses of delicate ferns. It appeared that the only routes into the interior were along the beds of brooks that entered the sea at intervals of a few hundred yards.

Later in the day, while I was alone on one of the beaches, however, I thought that I discerned a faint trace of a trail leading over a small point into the jungle. Before returning to the launch for heavy boots and briarproof clothes, I very incautiously determined to scout for a few moments, clad in nothing more than shorts, sneakers, and sun helmet. Accordingly I climbed the bank and proceeded crouchingly under the overhang of the gloomy woods. But I had gone only a few yards when I leaped involuntarily into the air because of a half-seen brown flash toward my knee. The jump was too late. A fer-de-lance had struck me on the inside of the right leg, five inches above the ankle. The snake now lay half coiled on the wet leaves, with part of its body concealed but its arrowpoint head held well above the ground.

My shin was dripping blood. I turned, dashed back through the brush and vines, down the steep bank to the beach, twisted on a tourniquet, fired my shotgun four times to attract the captain, and began to suck the wound, which, fortunately, bled freely. Apparently, the strike of the snake had been, so to speak, tangential. Only one fang had pierced the skin, and its direction had been just under the surface, instead of deeply into the muscle of the leg. At any rate, I am undeservedly alive to tell the tale, and the only noticeable after-effects were a slight stiffness of the limb and a round patch of skin which for about two weeks showed all the proverbial colors of a "black eye."

My next view of Gorgona was from the deck of "Askoy" on Sunday morning, April 20, 1941. It had been a dirty and squally night on the northward voyage from Tumaco. The flotsam-filled coastal water flashed constantly with luminescence, and every few minutes in the darkness we heard strange reports, like the crack of rifles, which seemed to come from the waves roundabout. The mystery of these was never solved, and to this day I do not know whether they proceeded from the lob-tailing of porpoises, the whack of a leaping fish, or from some quite different source. The water about Gorgona was now green, instead of ultramarine, and pale jellyfish as large as oranges so filled it that we could count at least one under each ten square yards of surface. We dropped anchor in nine fathoms, not far from the south end of the island, after getting most diverse soundings—two fathoms next to 18, for example,—among the corals.

There was a black woman in a shack ashore, and soon a man and two boys came in from sea in a large fishing bongo with balsa logs lashed along each gunwale. We hailed this craft and loaded it up with our soiled clothes for the woman to wash. Judging by the strident conversation that subsequently came from around the short stem of her pipe, she did not relish the task at all, even though she was going to be well paid for it.

The day was dismal, raw, gusty, rainy, and thundery. Columns of fog swept through the tenebrous forest. The fisherfolk, of whom many were in residence, stated that the weather had been very bad for several weeks, but they cheerfully predicted a pleasant morrow, with sunshine, a southwest wind and a calm sea. The *comandante*, Correia and I at once went collecting on the mountainside, well protected against snakes but not against the dripping foliage that quickly soaked us to the skin. Armstrong and the engineer made a better choice for the day by putting on a diving program where, as Oscar remarked, the rain couldn't wet them.

After a night of uninterrupted downpour, the promised better weather arrived, and the fishermen began to move back toward their mainland homes, carrying with them the dried fish, coconuts, and other products for which they had come to the green isle. From the first peep of dawn, canoes full of men, with an occasional woman and a few children, were passing southward along the six-mile length of Gorgona toward the outlying island of Gorgonilla. From that point they set their sails for the long trip to the continent which, because of the coastal current, would be attained far to the north of their starting point.

Gorgonilla was the site of a lighthouse, and presently "Askoy" received a visit from five Indian men in a beautiful cayuco that was painted black outside and red inside. This group evidently scorned balsa sponsons. The men stood bolt upright, each wielding a pointed red paddle and each clad only in a breech-clout and a hat. They looked able and self-reliant and they explained that they were employed in cutting a trail over the steep and jungly terrain of Gorgonilla, from the landing to the gas-accumulator beacon. The object of their call was to buy some tobacco from us. We made them a present of three packages of rather dreadful Ecuadorian cigarettes. Never was bread cast upon the water to better profit, because at evening the same five called again on their return toward their quarters and left us a huge bunch of bananas, a supply of sugarcane, and a heap of limes, papayas, mameyes, aguacates, and coconuts.

For four days more we lay at three different anchorages and found an opportunity to become reasonably well acquainted with both Gorgona and Gorgonilla. Once I crossed the southern part of the main island by one of its few forest trails. As I picked my way through the twilight of midday, I was glad to feel the snake-bite suction cup in a bag attached to my belt. Countless roots and lianas simulated snakes, but the truly live and moving ones were conspicuous to my overworked eyes. Gorgona is the home of at least ten kinds, including the boa constrictor and a dangerous coral snake, in addition to the fer-de-lance. There are also extremely long and slender tree snakes, as green as emerald, and several more, most of which I seemed to encounter in the course of my travels. Curiously enough, the boa, largest of all the species, was the only one that aroused no feeling of either suspicion or caution. One about eight or nine feet in length lay in kinks in an open path on Gorgonilla, its scales flashing iridescence in the sunbeams. It puffed and threatened with considerable bravado when Fallon and I approached but then gave up the bluff and decided to be unconcerned if not friendly. We made motion pictures of it, before waving it merrily on its way.

The forest floor of Gorgona was always wet and had always the warm smell of a palm house in a botanical garden. The climatic "greenhouse effect" was, indeed, very evident, for the air among the trees was extremely hot even when the open beach felt almost chilly. Dead leaves lay thick in most places, but yellow, sticky, and rather poor-looking soil was exposed along steeper parts of the trails. The condition was a reminder of the fact that much equatorial forest earth is unsuited to anything except the extraordinarily rich plant life that it originally supported. While one group of bacteria is reducing fallen leaves to humus, and humus to its organic elements, another group is busy denitrifying the bottom of the layer and changing the soil back to a mineral composition. It is for such reasons that tropical erosion, after the felling of a rain forest, often leads to unsightly and disastrous ends.

The most eerie event of my woodland rambles came when a great tree suddenly fell not far from where I was standing. At the moment there was no perceptible breath of wind; the dead trunk, long rotten, had merely attained its time. I have been puzzled ever since to comprehend how, in a region of frequent and violent thunderstorms, a tree could remain upright until it literally collapsed of its own weight. That is the only explanation I can offer, however; without warning, it leaned and toppled, then broke into fragments which crashed on the earth with a loud yet muffled sound, followed within the instant by profound silence.

(*To be concluded*)

THERE'S NO PLACE LIKE

The second and concluding installment in a discussion of dwellings around the world, illustrated by the American Museum's extensive collection of authentic house models

By HARRY L. SHAPIRO

Chairman and Curator,
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HOUSING or shelter of some kind is a universal need. It provides man with necessary storage space for his gear and supplies, it surrounds him and his family with privacy, and especially it creates a climate which contributes to his comfort or enables him to live in areas which otherwise would be impossible for human habitation.

Man has developed an enormous variety of house forms and has utilized an astonishing number of materials. Not always, however, is the construction or the material the most suitable. In certain areas and circumstances the choice of a building material is limited by its accessibility. For example, the pioneers who settled the treeless plains of the Mississippi Valley found themselves without a local supply of the materials traditional for house building in the areas from which they migrated. Logs were unavailable or scarce. Stone or cut lumber meant a long expensive haul from the East. Sod, however, lay everywhere underfoot, available to anyone at the cost only of his own labor. As a result, the "soddy" or sod house became the common dwelling of the pioneer. Its form followed accustomed lines. It was rectangular with doors and windows and resembled, except for its material, the familiar cabin.

It is interesting and significant that these pioneers did not adopt a form of shelter already widely used in the very area where they were building their sod houses. The Indian tepee, built of skins stretched over a frame of poles, might have served as a model for newcomers, since skins were easily obtainable from the vast herds of bison and construction of the tepee presents few engineering difficulties. Despite its convenience, it was rejected, because the tepee is a relatively inefficient shelter against cold. Although its thin skin covering, pegged to the bare ground, sheds rain and snow well enough and provides a welcome shade in the summer sun, its insulating value in below zero weather is negligible. Its redeeming virtues were the ease with which it could be assembled or dismantled and its extreme portability. For the nomadic tribes of the Plains these were prime considerations. They were, however, of no value to settled agriculturists who expected to remain on their quarter sections and who welcomed permanence.

Under the circumstances, therefore, sod or earth were the only choice open to the pioneers, who solved their problem in a fashion not too dissimilar from the semisubterranean earth lodges of the more permanently settled Mandan and Arikara, who were also inhabitants of the Plains.

Where the circumstances are not as stringent as this, tradition may influence the choice of material, as may be seen from another example from our own architectural history. The first English settlers in New England brought with them from East Anglia a familiarity with wooden frame construction. They found in their new homeland an abundance of wood, as well as of stone and clay for bricks. Wood, it happens, was universally adopted in preference to the more permanent stone and brick, partly because the trees had to be felled anyway in clearing the land, but also because the settlers' knowledge of house building was based on wooden models in the old country. Thus, tradition was largely responsible for filling New England with wooden houses.

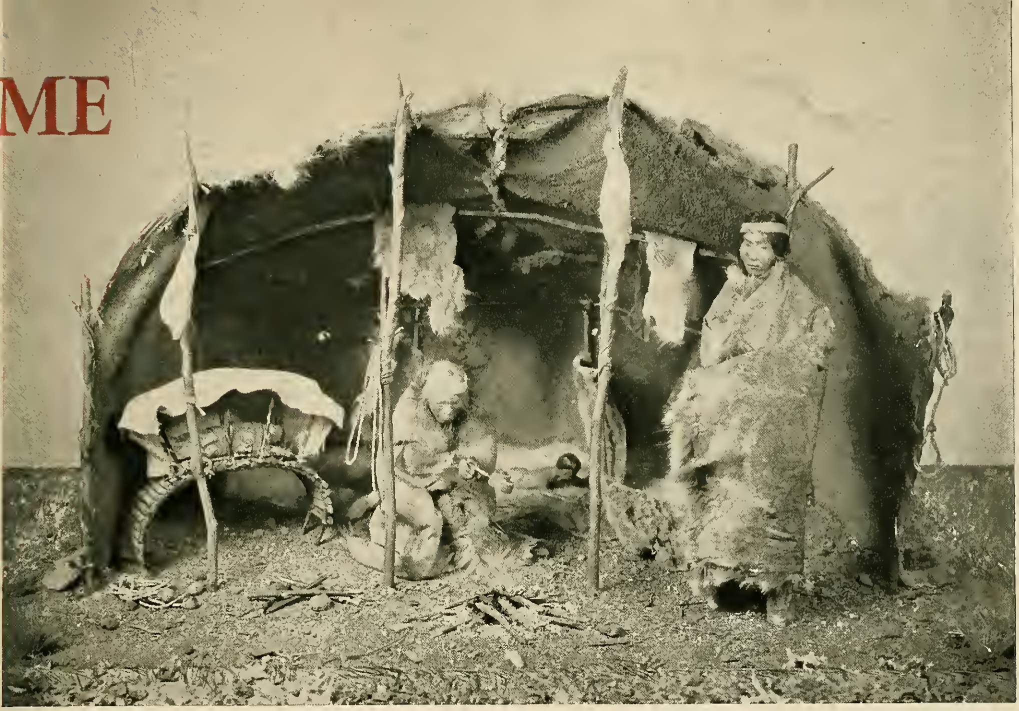
But farther south, the Dutch and Germans, who found a forest as abundant as in New England, preferred to build in brick and stone because they were already adept in the use of these materials in house construction. When the Western Reserve was made accessible for settlement, the New Englanders who migrated to this newly opened territory carried with them this already long established habit of home construction. In such early Ohio towns as Marietta, houses still stand that are faithful to the New England styles of the eighteenth century. Although time has changed the architectural detail, it would be interesting to know how much of the persistence of wooden frame construction in the United States today survives from the New England tradition established three hundred years ago.

Where the level of skill or culture declines, the influence of the environment becomes progressively ineffective in suggesting the best material or the most efficient construction. Thus we find the unfortunate inhabitants of the cold, raw land of Tierra del Fuego, who exist on a low level of culture, shivering behind their inadequate windbreaks, miserably protected from cold and wet.

All photos A.M.N.H.

▼ WINTER FINDS many natives confined to small, portable dwellings, prevented from using larger and more permanent shelter by the necessity of conserving heat and of moving in search of food. Here we see a camp of the Kutchin Indians on the upper Yukon in eastern Alaska as they

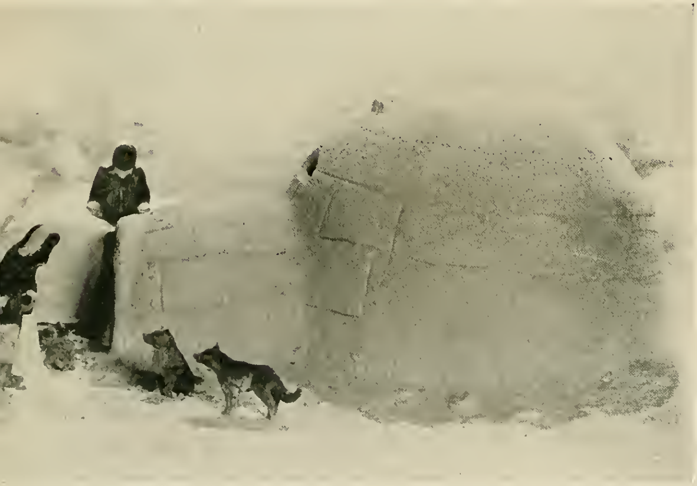
IOME



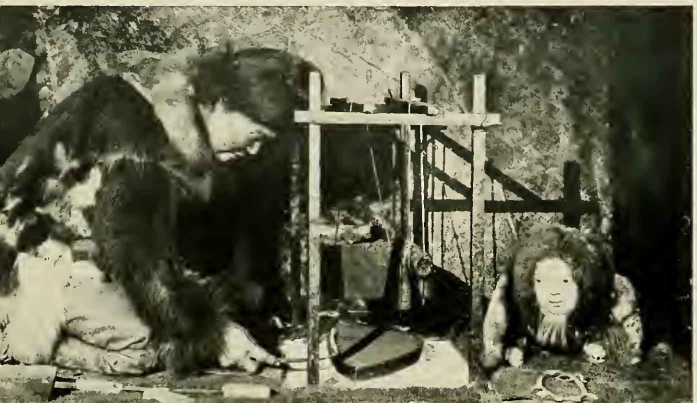
vere observed about 1850. The Arctic Circle asses through their country, and the winters re long and cold. The usual type of winter ouse, as shown here, is dome-shaped, with rched poles supporting a skin cover. Sleds rawn by dogs are in use, and hunting nd fishing are the chief occupations

▲ A CRUDE WINDBREAK and the simplest of skin clothing constitute the only protection enjoyed by these Tehuelche in their chilly homeland near the southern tip of South America. Their tent, or toldo as it is called, is an interesting illustration of evolution in house design. Four centuries ago, at the time of Magellan's historic voyage, the Tehuelche lived in an even smaller and simpler shelter resembling that of their neighbors, the Onas (illustrated in the previous chapter). But, like some tribes in our own country, they soon learned to use the European horses, and by 1750 they had become a tribe of horsemen accustomed to treks through thousands of miles of country. This permitted them to carry this larger shelter. Notice that even the baby's cradle has been altered to fit across a pack load

▲ THE NECESSITY OF TRAVELING in search of food requires the Eskimo to move all his worldly belongings in winter on a sled. He has solved his house building problem so effectively that he needs to carry only a snow knife in order to construct a dwelling in which he can live comfortably for weeks or months



▲ A SHORT TUNNEL and protecting wall bar the doorway from bitter winds and provide shelter for the dogs. Illumination within is improved by a window of clear ice, here seen above the door



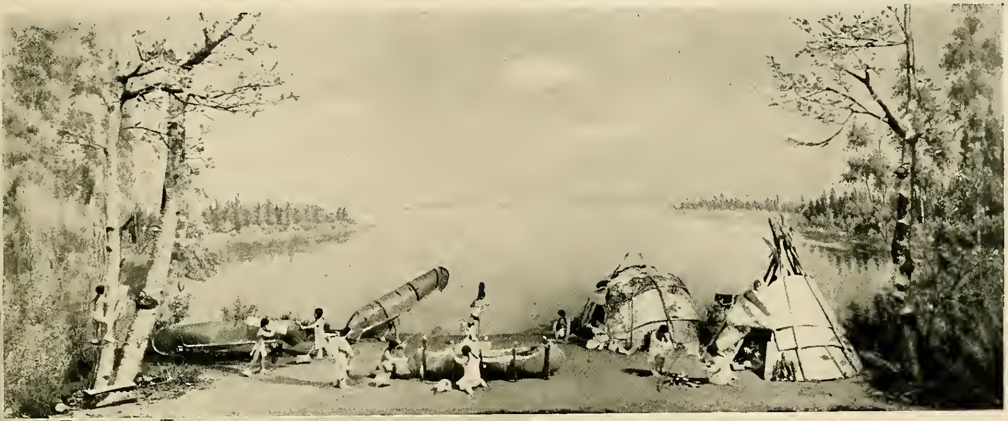
the home

When the natives are ingenious and skilful, we see remarkable adaptations to material and weather. The Eskimos' invention of the snowhouse illustrates how the ingenuity of skill can overcome the rigors of climate and the paucity of material to produce a satisfactory solution to a difficult problem. In this instance, the specifications are formidable. The Eskimos normally live in semisubterranean sod or stone houses, but certain groups who travel during winter and pass considerable time on the sea ice need another kind of house. Since the winter temperatures are extreme, this dwelling has to provide warmth and protection from the cold. Moreover, the material has to be something easily available, because the only method of transportation, the dog sled, rules out the possibility of carrying suitable building material. Skins or felt are inadequate to the conditions, and stone or wood are too heavy and cumbersome for building when speed is essential. Digging a semisubterranean shelter is impractical in winter even on land, for the earth lies solidly frozen beneath the snow, and of course impossible when traveling over the frozen seas.

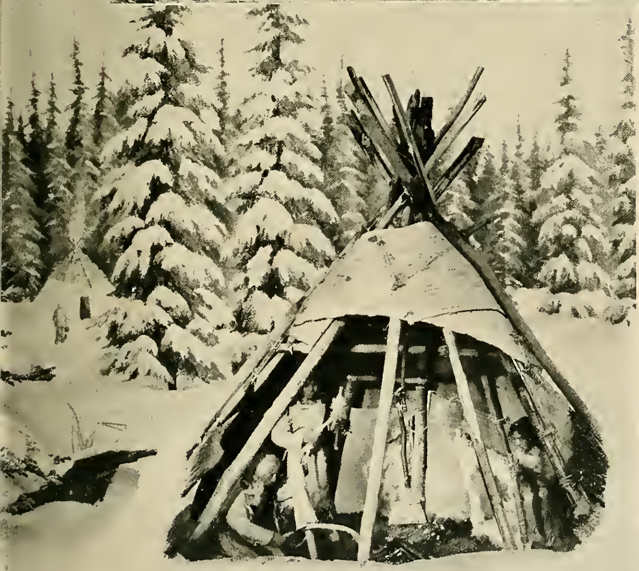
Without some kind of an answer to this problem, winter travel would be out of the question, and hunting —a constant necessity for the Eskimo —would be dangerously limited. The genius of the Eskimo surmounted these obstacles in his invention of the snowhouse, which can be erected within an hour out of material everywhere at hand and in which he can live in comfort.

◄ THIS INTERIOR of an Eskimo snowhouse exhibited in the American Museum shows the skins that are sometimes pegged to the snow walls to give greater insulation from the cold. Eskimos frequently remove their upper garments in the snowhouse, because the temperature is brought well above freezing. The seal oil lamp that the woman is tending here is a shallow stone receptacle for blubber. The melted blubber burns through a moss wick

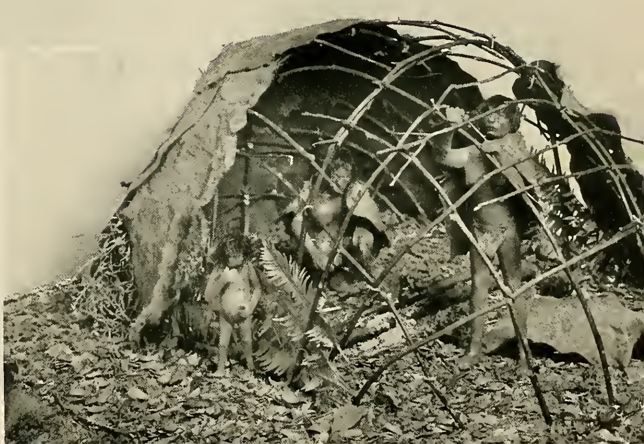
# of the traveler



▲ Reliance upon materials easily available has resulted in the elaborate use of birchbark by the roving Ojibway Indians. Note that two shapes of shelter are constructed with the same material, one dome-shaped, the other conical. In the center a birchbark canoe is being made, and at left an Indian is stripping the bark from a tree

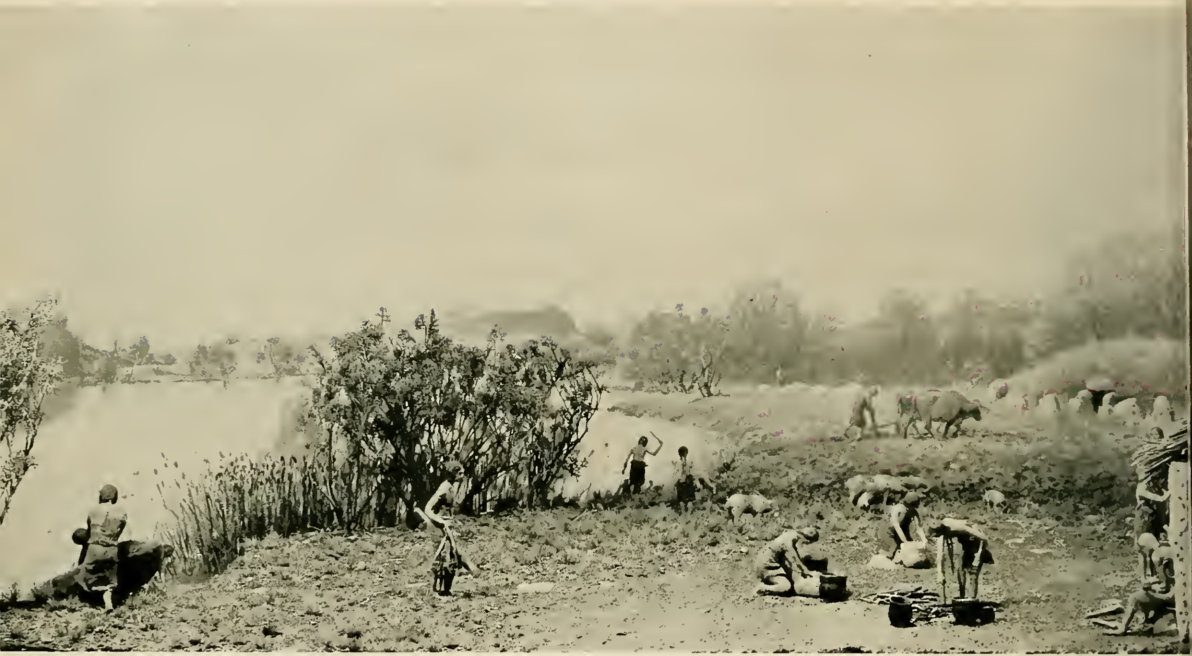


◄ The Cree Indians near Hudson Bay also use a tepee covered with birchbark. Sometimes caribou skin is used instead. These Indians make extensive use of rabbit skins for clothing, in the production of which the women shown here are engaged



➤ As many as seven or eight persons live in one of these huts used by the Alacaluf Indians in an exceedingly rainy climate near the southern end of South America. Four sticks are put in the ground and bent over to form two parallel hoops. Other poles are then forced into the ground and bent across in the other direction, and lighter poles are added to complete the dome-shaped framework. Ten to twelve sea lion skins form the covering. The two doors at opposite sides are screened against the wind by fern fronds. A fire is built in the center of the hut and the occupants sleep at either end. When they travel to another location, they take only the skins with them

the permanent



▲ IN CONTRAST to people who follow a nomadic existence, those who pursue settled occupations such as farming are apt to be found living in permanent dwellings. Even in about 2700 B.C. the Neolithic people of Denmark are known to have erected substantial houses of wattle and daub, as illustrated in this model. The mound in the background was used for burial purposes

ome

Although the material may influence the design and structure of a house, it is not the only criterion by which houses are differentiated. The manner in which a building is employed may be as important as, or even more important than, the material itself.

The birchbark and the skin tepee, while differing in material, are essentially the same in structure and design. Similarly, stone or brick may be used interchangeably with little or no modification in the type of house itself. On the other hand, the same material may be applied to structures widely divergent in design. The domed shelters of the Winnebago, the tepees of the Ojibway and the Cree and the lodges of the Iroquois, despite their variety of shape, size, and construction, were all covered with bark. In distinguishing these abodes architecture is obviously more important than the nature of the covering spread over the skeleton of the building.

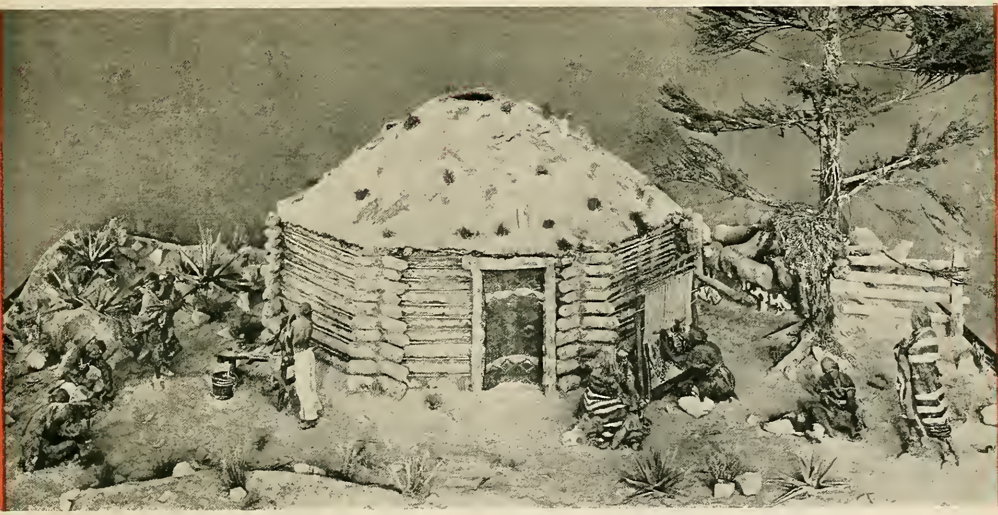
Most of the house types among the uncivilized folk of the world are one-roomed affairs in which the high degree of room specialization familiar to us is absent. Here a single room contains most if not all the activities that we disperse among kitchen, bath room, dining room, living room, and bedroom, not to speak of the libraries, music rooms, game rooms, bars, offices, dens, studies, etc., of more elaborate establishments. The departures from the basic one-room plan and they are never very great, can usually be traced to specific circumstances in the life and environment of the inhabitants.

In warm climates, where the heating problem is not acute and the warmth generated by cooking need not be conserved, detached kitchens are often found. Where special structures are not put up, the cooking may even be done out of doors.

Agricultural people, who must store food in large quantities, frequently build for this purpose special storehouses or rooms as in the pueblos of the Southwest. But in general, a single room suffices, and may in cold regions be necessary in order to take advantage of every source of heat, artificial and human. Anyone who remembers an old-fashioned farm house in winter with its annual contraction of domestic life to a single room, usually the kitchen, can readily appreciate the advantage of the one-roomed dwelling.

◂ A GABLED HOUSE of bark is the home of the Sauk and Fox Indians west of Lake Michigan. Their elaborate use of basswood in the making of useful articles is illustrated in this model

▾ The Navajo Indians of Arizona and New Mexico build this characteristic log and mud house known as a hogan. Their life centers around the cultivation of corn and the tending of sheep, whose wool is woven into blankets as shown here



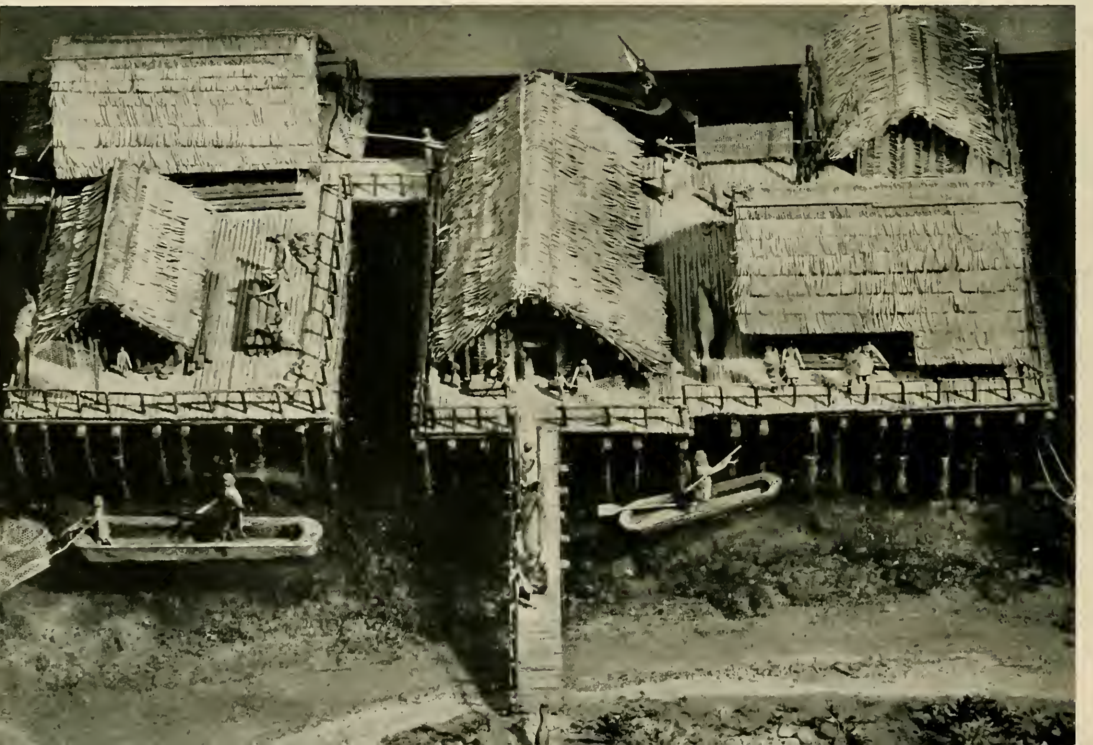
In more beneficent climates, sleeping quarters may be divided from the main room, and even special houses are sometimes erected where the young men of the village retire to sleep.

Among most people, the house is designed to accommodate a single family and is therefore small. These small units, however, have a definite relationship to each other. With the few exceptions to be mentioned, these units are detached but arranged in a village pattern, usually either along a street or in a circle. The latter arrangement, adopted by the Plains Indians, provides some protection against attack by hostile neighbors. Walls, too, are often an essential part of the village design either for defense or to enclose domestic animals. The famous kraals of southeast Africa were regularly surrounded by a stake fence within which the cattle could be confined. Walls to ensure family privacy are also known in rather more complex groups. The compound with its surrounding wall, found in Malay groups, is an example of this, and analogies to it exist in other parts of the world as well.

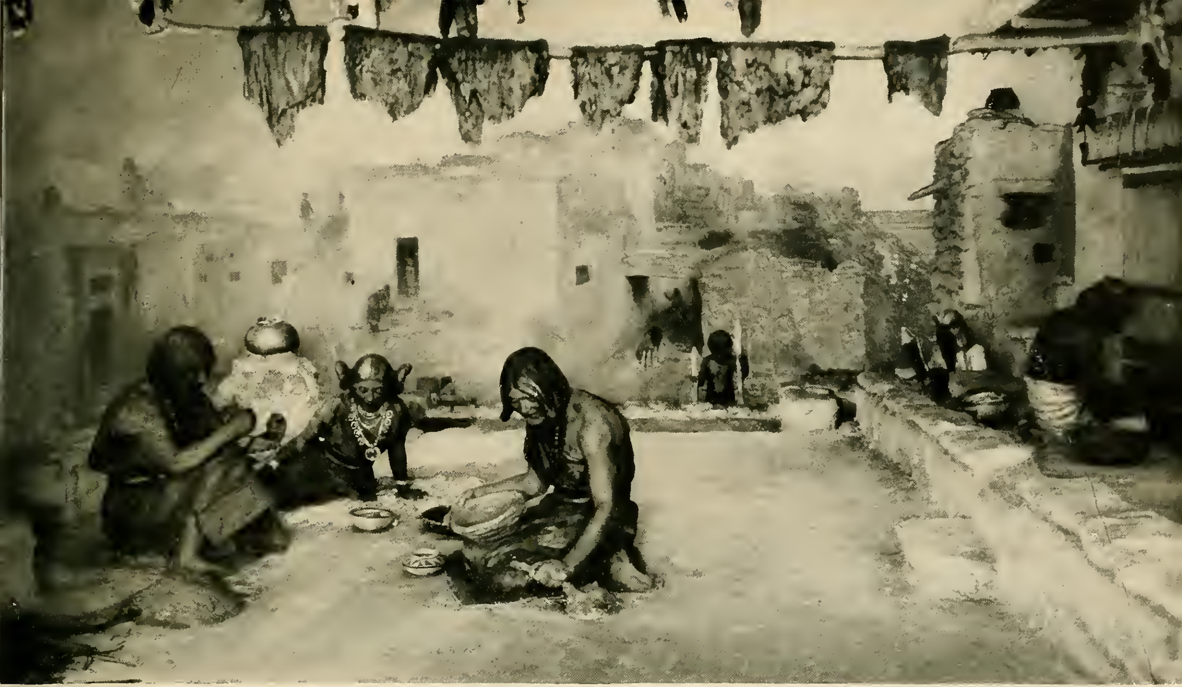
One of the most interesting village arrangements in aboriginal America is the pueblo of the Southwest. It is a single structure consisting of attached units all forming an apartment-house-like building, in contrast to most villages, where the family units are detached and separate. The pueblo takes several shapes but typically rises several stories, with each one set back from the one below it.

These examples of house plans and village arrangement are all drawn from social and familiar structures where each family inhabits its own private dwelling. Social custom, however, may decree a more intimate form of living. In such societies we find communal houses occupied by several families (such as the long house of the Iroquois) or even by the entire village where such groupings are small in size. The dwelling then becomes considerably expanded in order to shelter under one roof a relatively large number of people. The Iroquois long house was often from 50 to 100 feet in length, and the Haida built substantial communal structures 40 by 100 feet. Each family usually had its own recognized section of the large hall-like interior, where it might store its goods and possessions and where it could retire to sleep. Thus, social organization, mode of life, and climate tend to modify and control the house plan and the village arrangement.

community



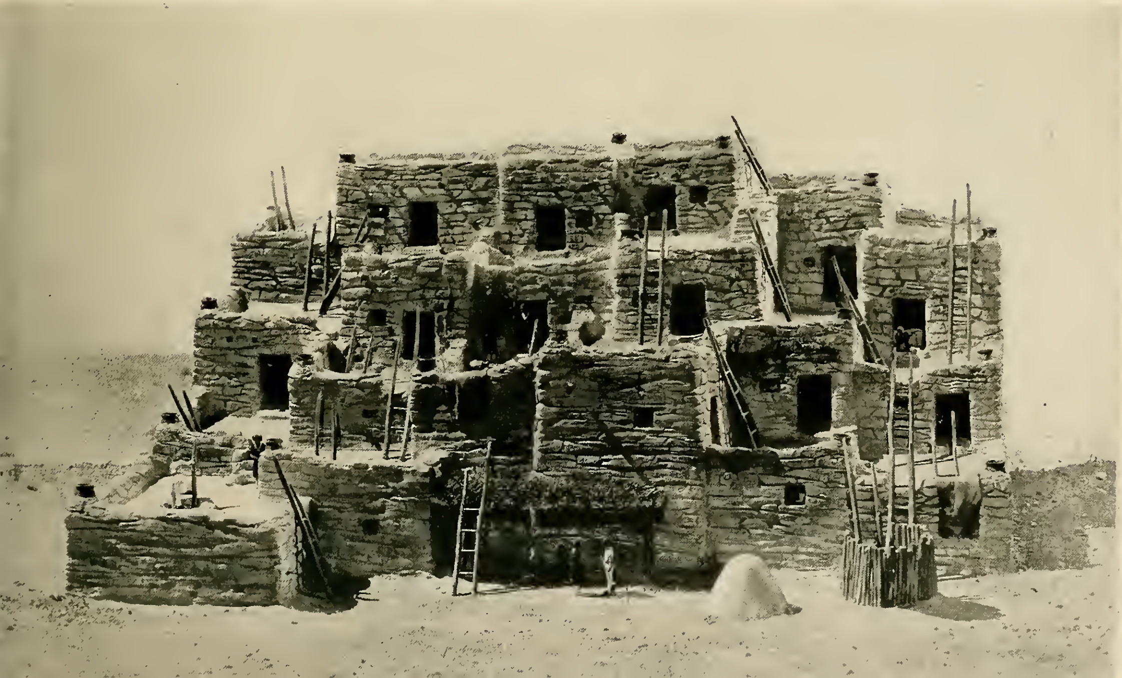
▼ Architecture and village plan usually reflect the community life of the people. Even as long ago as the time of the prehistoric Swiss lake dwellers we find an orderly arrangement of houses forming a well-knit social unit, as shown by this scientific reconstruction based on archaeological evidence. A narrow wooden causeway, easily defended against enemies, connects the village with the shore. The people belonged as much to the world of water as to that of land, but their social life was circumscribed and conditioned by the narrow boundaries of their pile-supported village platform. A foundation so difficult to build would be expected to do for many generations



life

▲ An "island world" of a different sort is embraced within the walls of the Hopi pueblo. Community life there fits into an environment of roof tops. These houses are built and owned by the community instead of by individuals or families. The woman at left is making a coiled basket; the one in the center is "building up" a pottery vessel by adding successive rounds of clay

▼ On first view, the compact Hopi pueblo, accommodating many families on different levels, suggests certain resemblances to our city apartments. But its community life is much more intimate. Everyone knows everyone else, and the various roof levels, accessible only by ladder, interconnect with one another



UNQUESTIONABLY one of the most distinctive features in a house is its method of construction, by which I mean not only the manner of building the house but also its relationship to ground level, and its decorative features. If we include as houses all kinds of shelters, they may be classified into the following basic forms: open shelters (lean-to's and windbreaks), the circular house (either dome-shaped or conical), and the rectangular house with pitched or flat roof. Variations and elaborations of these typical forms are, of course, numerous. I have not included caves in this classification, because they are natural phenomena, exhibiting no evidence of human construction. A claim might of course be made for the artificial caves used by some of the Chinese or masonry-fronted caverns of southwestern Europe.

The open shelter may consist of a series of stakes or branches joined to form an open shell-like structure, covered with leaves, skins, earth, or some other suitable material. It may also be a simple wall to deflect the wind, or it may be a lean-to type where the wall is inclined to form a half roof. These devices, which are of the most primitive character, are nevertheless widely distributed. The Australian aboriginal often uses nothing more. The Apache of the Southwest sought protection behind a similar screen. I have seen natives in the Malay jungle bedded down under such an open-sided shelter that was covered with broad leaves as a kind of thatch. It is at best a makeshift and suitable only as a temporary lodging for nomadic people living in warm climates, where its ability to shed rain may justify it. To find such a poor protection in common use among the Ona of Tierra del Fuego, where cold wet winds are frequent, seems contrary to the rule that man adapts his shelter to fit the environment.

The circular and the rectangular house are fundamentally distinct in their structure. In the former the roof or covering is often a continuation of the walls, which must therefore slope inward. This type of construction simplifies the problem of the roof and renders the circular house a highly desirable form under certain circumstances. Some circular houses do, however, have distinct roofs with overhanging eaves. But this shape, of course, limits the size of the house, since too great a diameter would create engineering problems of considerable magnitude.

There are many variations in the basic plan: the beehive house found in Africa, the simple dome covered with skins or felt among the tribes of Northern Asia, and the classic tepee of North America. Fibers, grass, mats, and mud can generally be applied effectively as a covering, but other materials too are used. The skeleton is generally a simple one of poles, interlaced branches, or of horizontal members tied to uprights set into the ground. Among the Eskimos, where wood is often hard to come by, the native builder has sometimes used the curved jawbones of the whale for the frame, covering it with sod.

The rectangular house represents a more adaptable form of dwelling, since it allows greater floor space and more head room. At the same time, this type of house may be enlarged without overtaxing the architectural skill of the primitive builders and becomes, therefore, the preferred form where engineering knowledge has advanced but not yet reached the virtuosity required for large domed edifices. One of the major problems presented by the vertical wall is the break between the roof and the wall itself, which must be protected from leakage. In dry climates a flat roof is generally adequate, but in areas of abundant rain or snow, the roof must be pitched sufficiently to allow water to drain off rapidly. It is necessary, furthermore, to protect the top of the wall from absorbing moisture directly from the rain or from the runoff. The roof, therefore, becomes a cowl resting on the walls by means of a series of rafters, which meet along the ridge and project beyond the walls as eaves. This technical solution to the problem makes it possible for the builder to widen his dwelling, which he does at the expense of heavier wall construction, to support the increased weight of the roof. The simple pitched roof is by far the commonest form among these structures. Intersecting roofs with troublesome valleys at the junctions are never attempted by the primitive. The other two roof constructions in modern dwellings, the lip-roof and the mansard, are unknown. All the most highly evolved houses found among uncivilized natives belong to the rectangular category, and in such forms as the plank house of the Northwest coast or the elaborate houses of the Mernagkabau of the East Indies the architectural knowledge displayed is very impressive.

ALTHOUGH modern architects have become increasingly concerned with the relationship of house to terrain and have achieved novel and interesting adaptations to land contour, their purpose is largely esthetic. The primitive builder, on the contrary, builds his house in relation to the land on more practical considerations, but he manages in certain instances to achieve notably pleasing results. Not only does he build conventionally, resting his house directly on the ground; he also goes underground and above the ground.

The true underground house has no counterpart in modern domestic architecture, yet it is a most efficient manner of insulating a dwelling from cold by making use of the same principle that keeps our cellars warm in winter. It is a form of construction found only in the most rigous climates. The classic type is the Koryak house of northeast Asia, but variations where the excavation is shallower are found among the Eskimo and among the prehistoric people of the Plains. In fact, the semisubterranean house has been traced over a large part of Eurasia and North America. It is possible that the subterranean ceremonial kiva, in which the Pueblo Indians perform their sacred religious rites, may be a survival of an underground house type once employed by their ancestors when they ranged farther north, just as our own religious architecture tends to preserve antique styles long abandoned for secular construction.

ELEVATING the house off the ground is achieved by primitive builders by means of stone platforms, by piles, or by building in the trees. The Marquesans, for example, set their dwellings on stone platforms which formed a terrace surrounding the house. The use of wooden piles for supporting a house is fairly common, the earliest known being the prehistoric pile dwellings in the Swiss lakes. Modern examples may be seen in tropical America and various Pacific Islands.

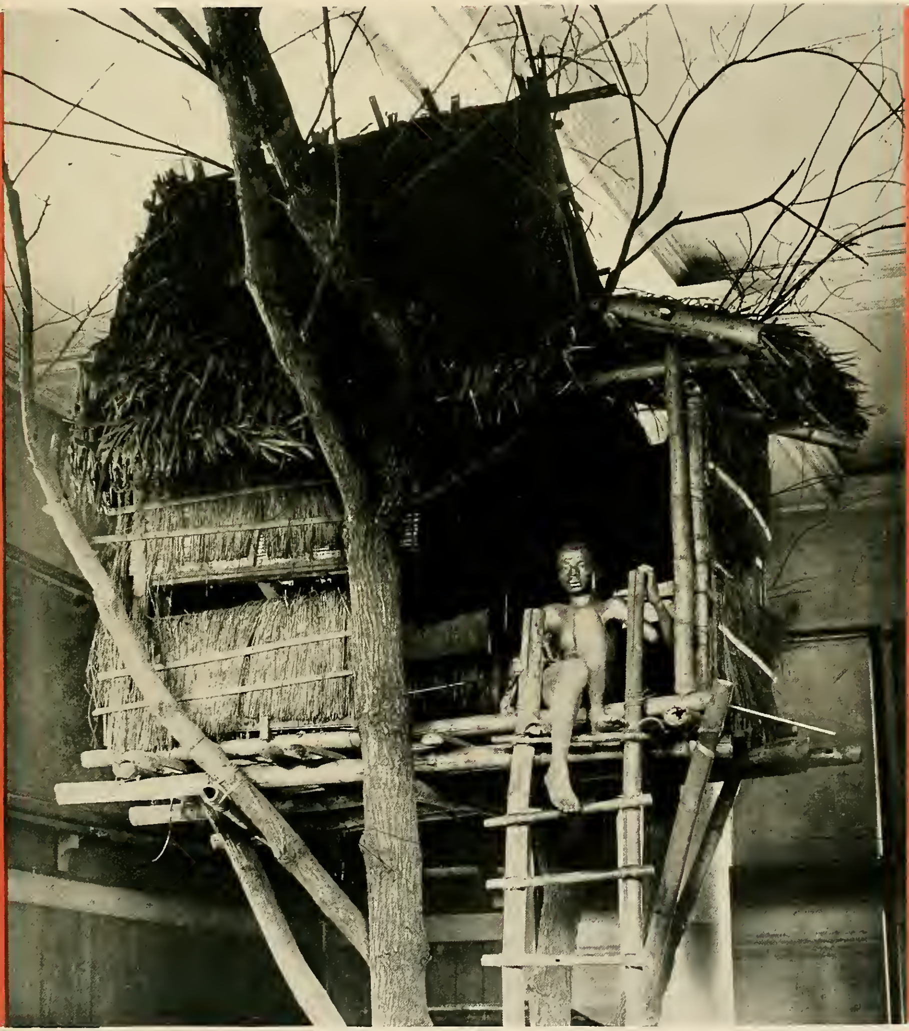
There are several reasons for adopting this method of construction. The most dramatic is the protection that a pile-dwelling, set in a lake, lagoon, or along the shore, affords its inhabitants. Since a dwelling enclosed in such a natural moat cannot be approached on foot, a measure of safety is thus automatically assured. Some of the villages in the lagoons and along the shore of Melanesian Islands are said to have been built by people who formerly sought refuge there from their land-based enemies. Such a strategic retreat could prove a blessing for fisherfolk, who would find their source of food conveniently at hand.

Tree dwellers such as the Gaddang and Kalinga in Luzon and the Manobo and Mandaya in Mindanao set their dwellings as high as 40 to 60 feet in the branches of trees. These lofty eeyries provide an excellent protection from human enemies.

Pile dwellings, more prosaically, by raising the floor of the house above the ground also offer another kind of protection—relief from vermin, animal incursions, and the humid exhalations of damp village sites. Native housekeepers find their superior elevation a convenience in their domestic tasks, since garbage may be easily disposed of below the house where the scavenging pigs of the village have free access.

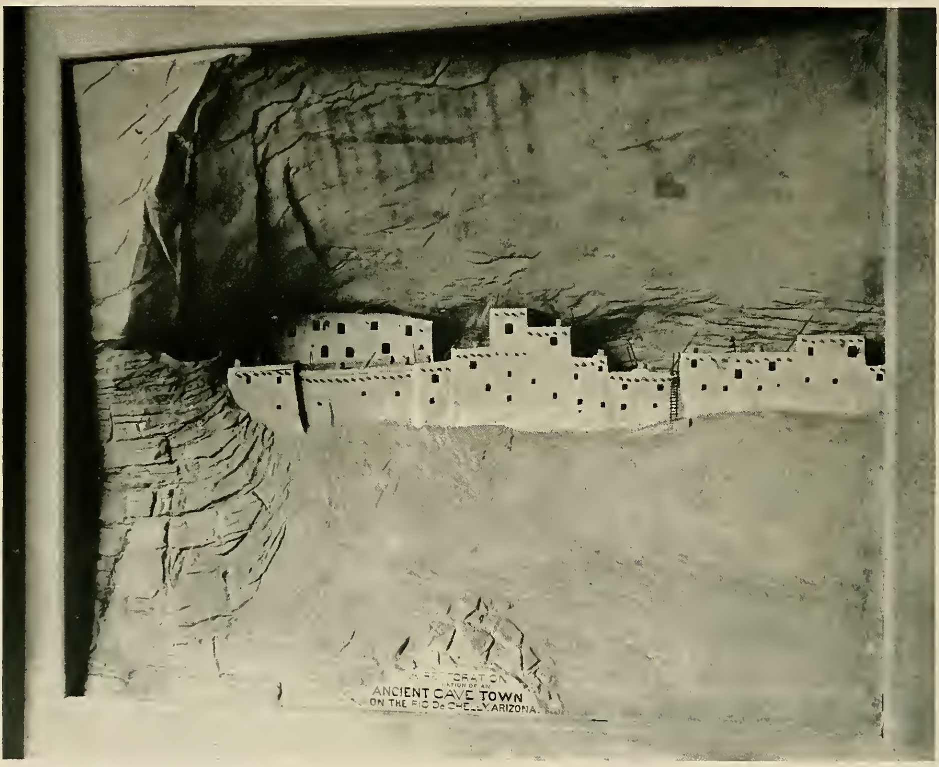
protection from enemies

▼ **Tree dwellers** in the Philippines build their houses as high as 40 to 60 feet above the ground and thus secure excellent protection from human enemies. This is a full-size model on exhibit in the American Museum of Natural History

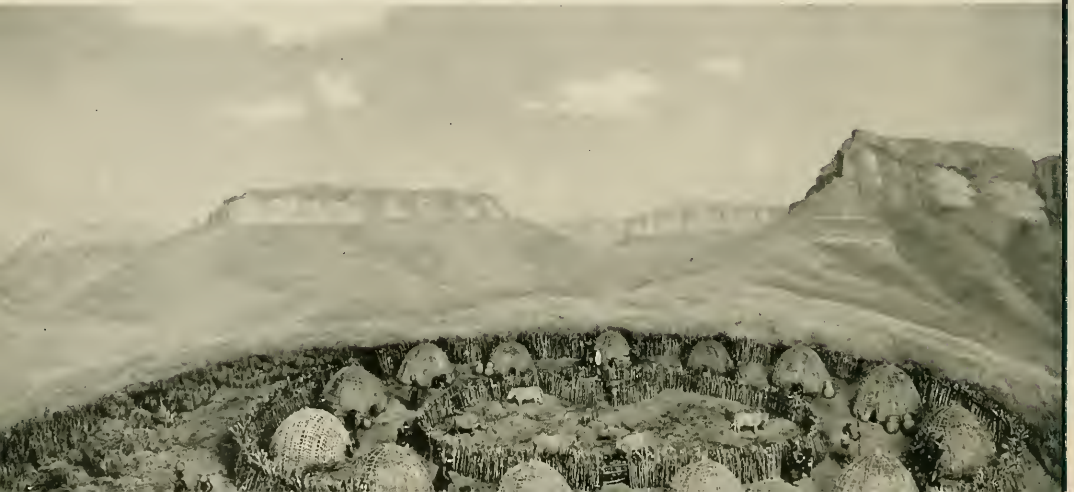


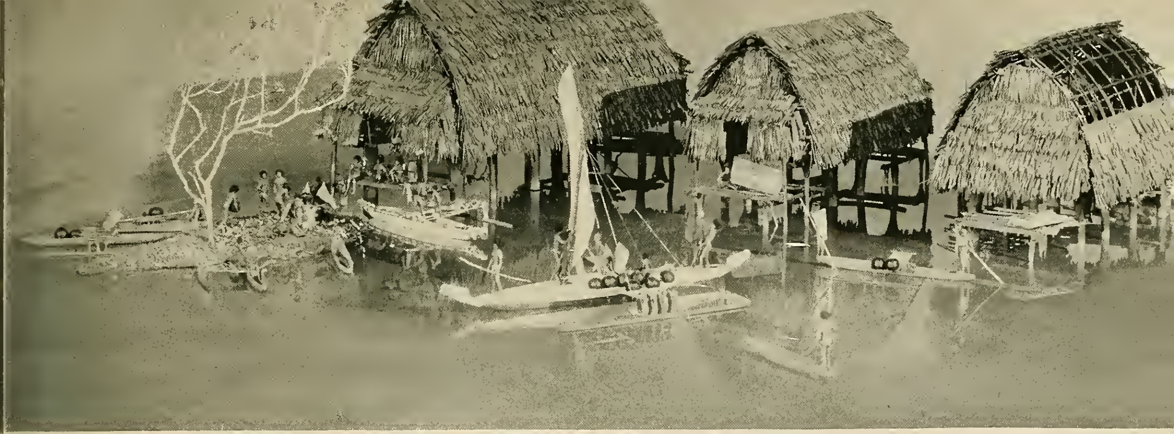
protection from enemies

▼ PROTECTION AGAINST ENEMIES was attained to an extraordinary degree by the builders of the cliff dwellings in Southwestern United States. Extremely long ladders were sometimes the only avenue of approach. Protection from the rain was usually given by the overhanging cliff above. The stone and adobe buildings were plastered in a color closely resembling that of the surrounding cliffs. This model is a replica of a cliff village in the Canyon de Chelly in northeastern Arizona.



▼ The Zulus of Africa protect their cattle within a double circle of fencing, with the village huts occupying a unique position between the two rings

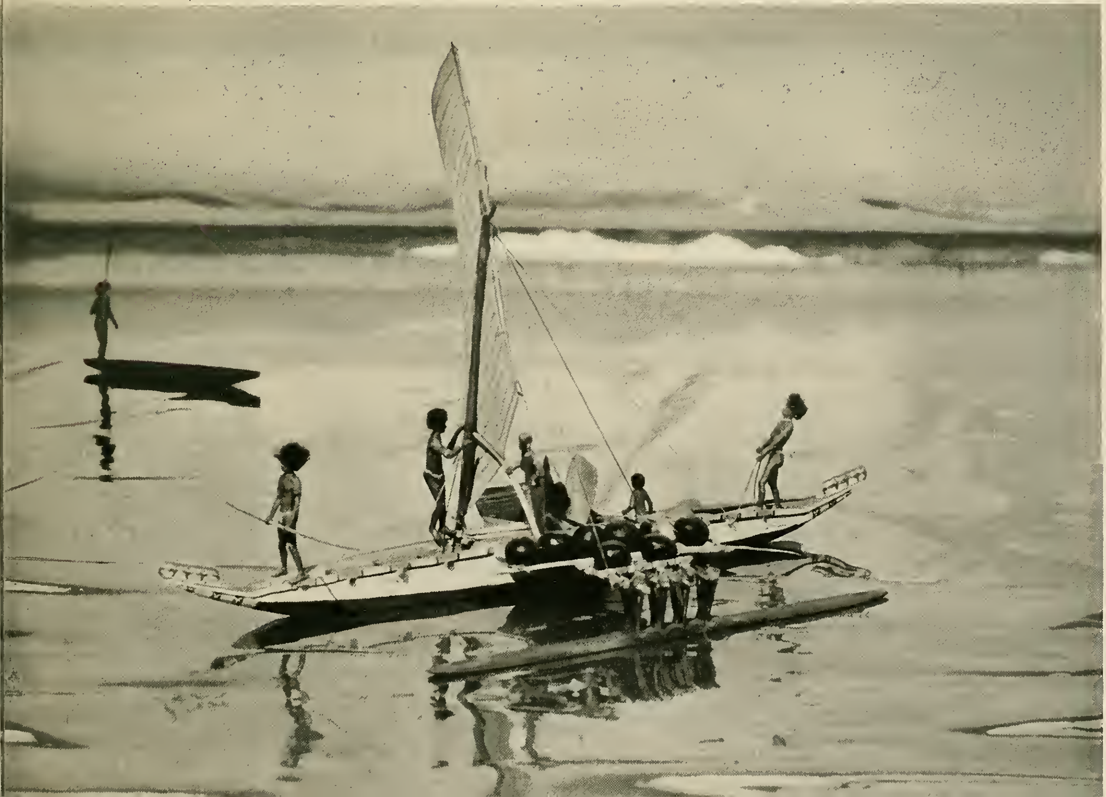


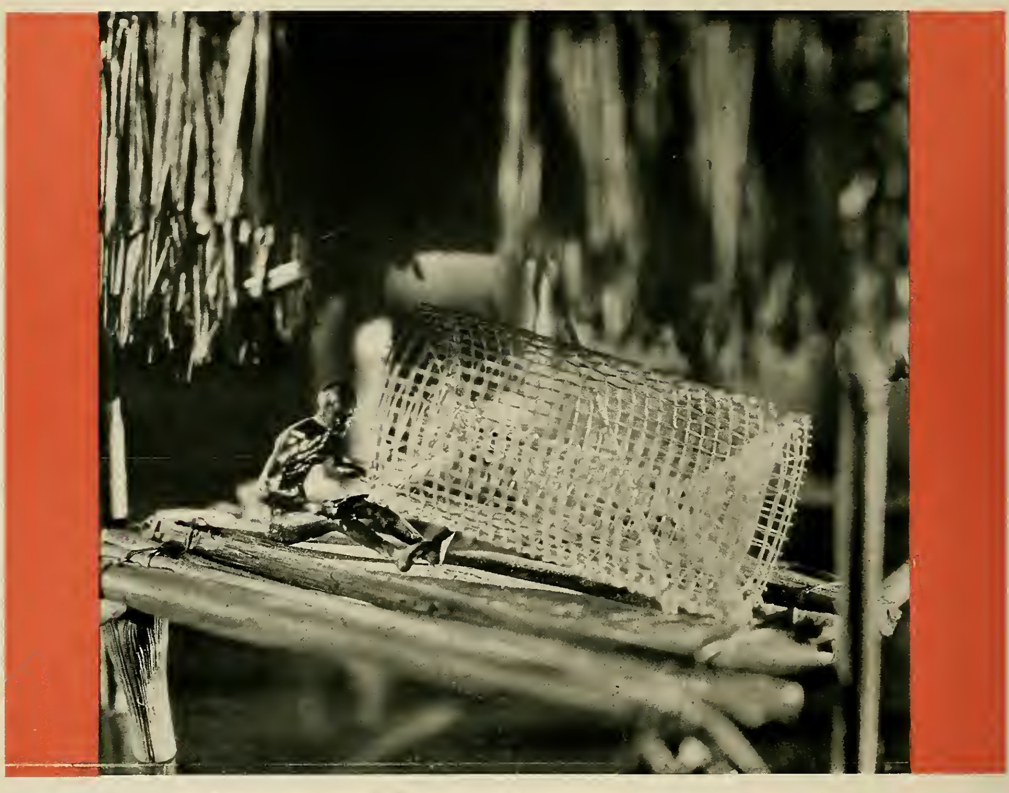


▲ THIS MODEL OF A VILLAGE of the Manus tribe in the Admiralty Islands is a beautifully executed example of house design showing the community life of a people who dwell over the water. For all the necessities of life, these people depend upon their skill in fishing and in navigating their large outrigger canoes. They trade fish for vegetable food and for wood for their houses and canoes. Note that the natives have painstakingly built up in the sea a small island of coral rubble to serve as a "town hall," where important meetings take place. Elaborate feasts connected with marriage, birth, and death enliven their isolated community life

a village over a lagoon

▼ THE PEOPLE OF THE MANUS tribe make voyages to distant islands in sailing canoes like the one reproduced here in miniature. A cargo of pots is being brought as a handsome gift to the kindred of a young man who is about to be married. His relatives have already paid many hundreds of dogs' teeth to signalize the marriage



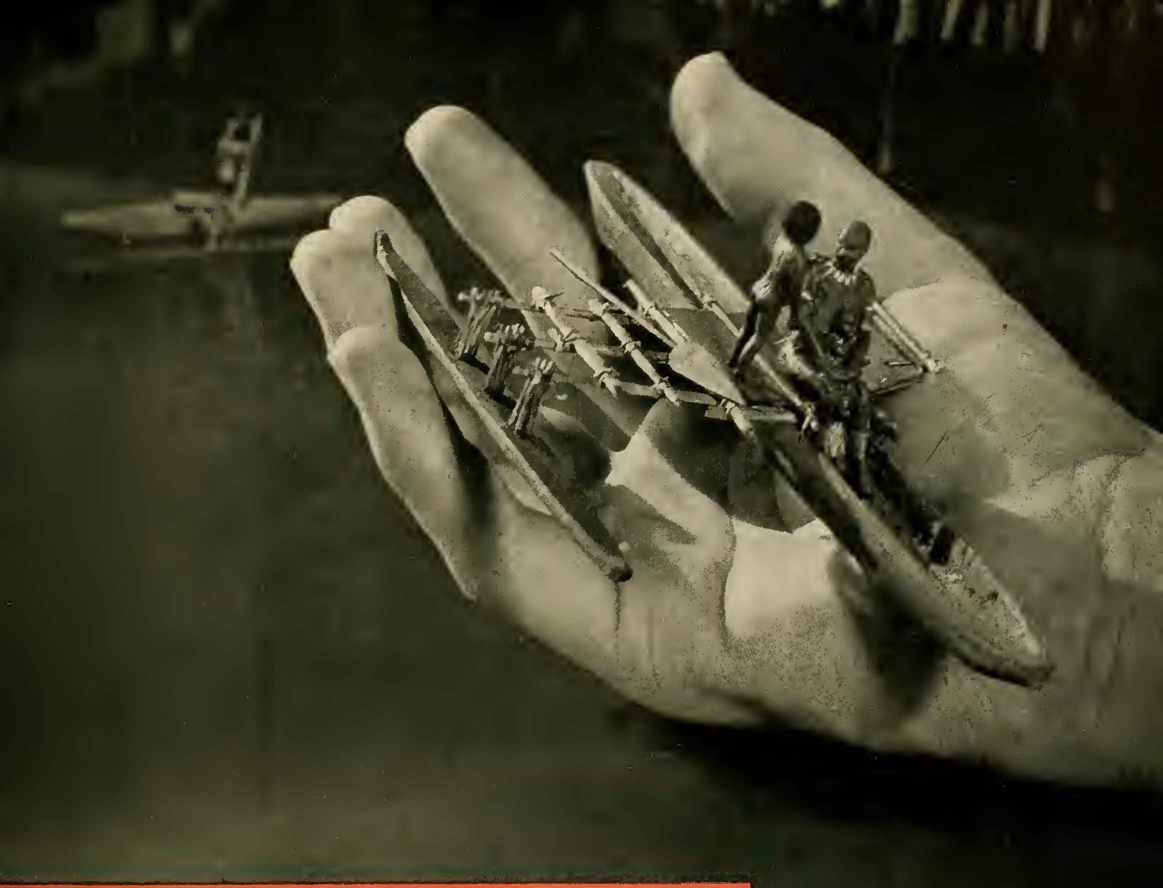


▲ A DETAIL VIEW from the model of the Manus village showing the construction of a cylindrical fish trap. Many important phases of the life of the people are shown within the single model. Such an exhibit is possible only after many months of scientific study among the people. The investigator may have to learn to speak the native language in order to secure all the necessary information. In addition photographs and drawings aid the Museum's technician in reconstructing such a model

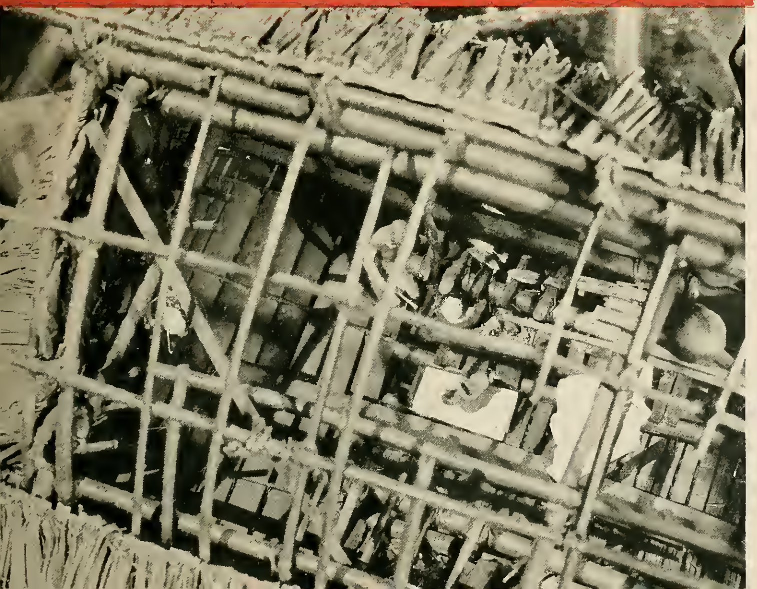
▼ EVERY OPERATION in building the full-size house is performed by the model maker, who thus produces in miniature an exact scientific replica of the original

▲ IN THIS INSTANCE, before the model house is completed its inhabitants must be put inside, because one is intended to see them busy at their daily tasks through an opening left in the roof

► THUS, THROUGH the blackened rafters one sees the woman of the house preparing a meal of fish.



▲ SCRUPULOUS attention to detail is observed in every stroke of the knife in fashioning the smaller objects for one of these models, in this case an outrigger canoe, identical except in size with those used by the Manus tribe



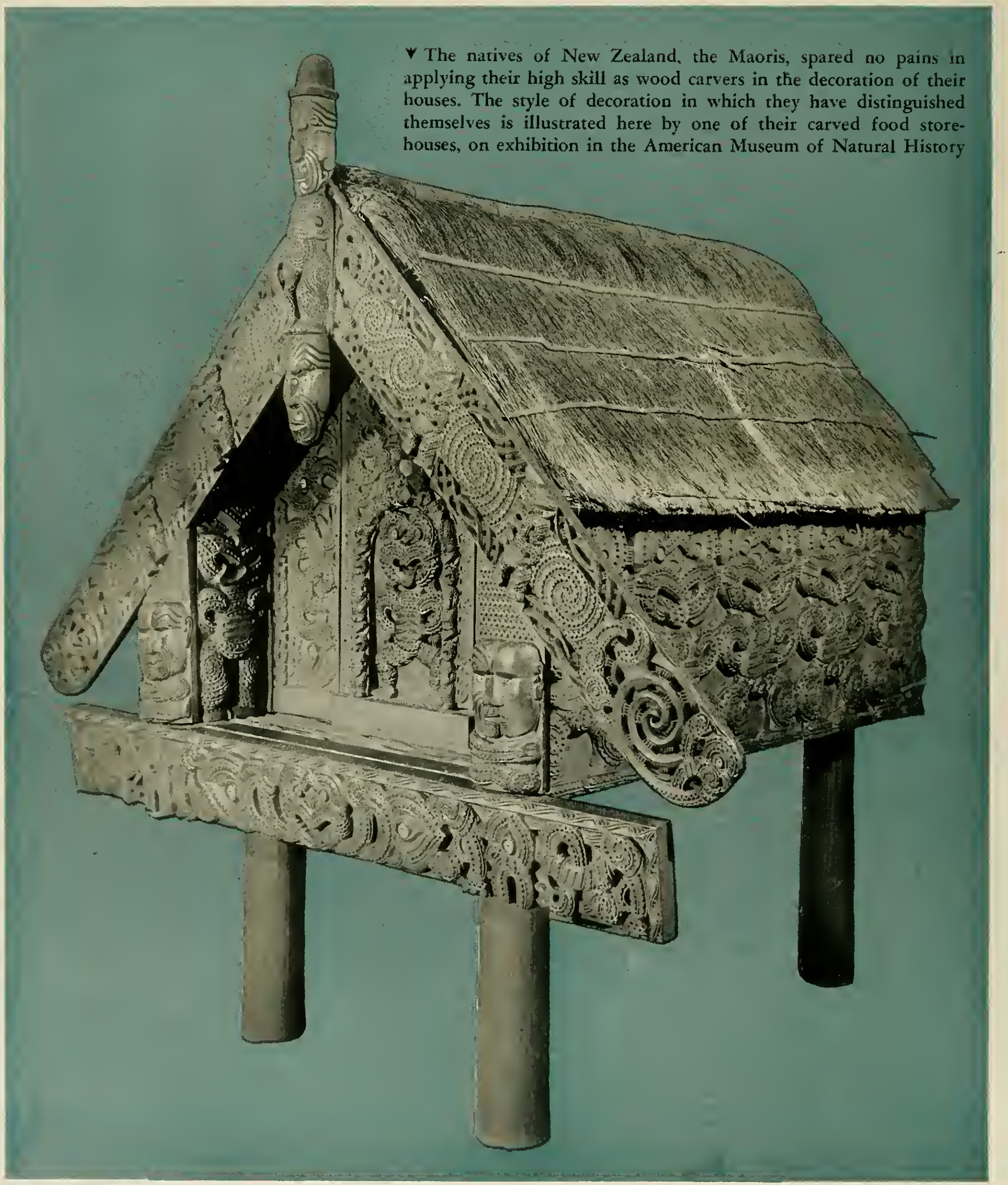
WHATEVER beauty most types of native houses possess is functional and accidental. It springs from the quality of material employed and the surface it lends, from the shape and mass of the house itself, and from the structural details of the building. The esthetic distinction not infrequently evident in these simple houses does not represent a conscious striving for an effect; it is the natural result of the construction.

I recall vividly the pleasing effect which the under side of a thatched roof produced in the interior of a Polynesian house in which I once lived. The steep, lofty rafters, completely exposed from below, were covered by overlapping layers of thatch, narrowly spaced. This simple, functional finish was perfect in itself and needed no further adornment.

In a few noticeable instances, however, the native builder does consciously attempt to enhance the beauty of his work by additional details that have no purpose save to enrich the architecture. The Maori of New Zealand elaborately carved the gables of his house with fine scroll and openwork inlaid with shell, and he frames the doorway with similar decorations. Carved and painted designs of great elaboration are used by the Tlingit and Haida to embellish their houses. House decoration reaches a very high level in the East Indies, where carved and decorative elements are frequently incorporated into the façade and gracefully curving roof lines, and where telescoped gables and sweeping eaves are exaggerated for their esthetic values.

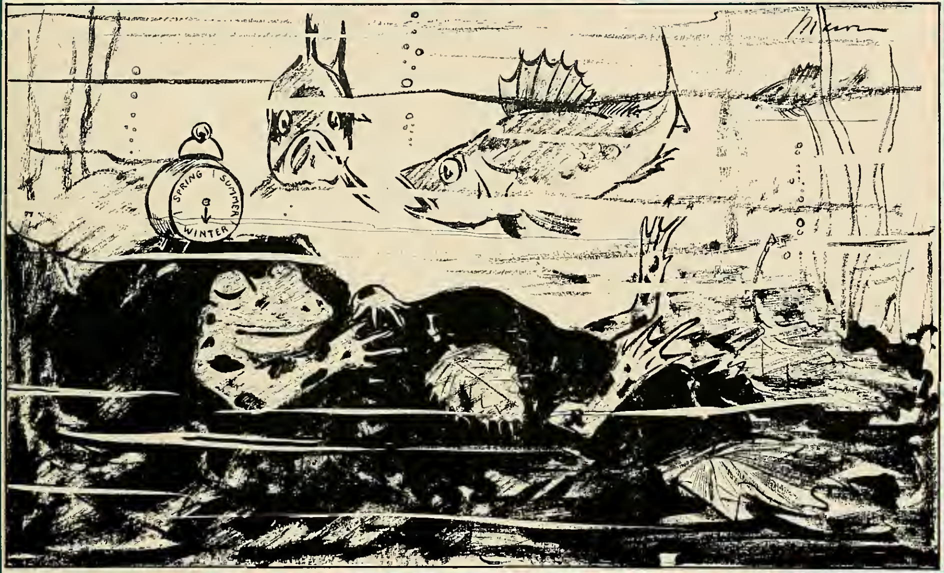
Some of the most interesting examples of primitive house decoration are the molded walls of African mud houses. The plasticity of this material lends itself particularly well to the vivid fancy of the African natives, who often achieve very striking effects by simple means.

The house, however humble, embodies and reflects so much of our history, our traditions, our skill and culture; it speaks so eloquently of our opportunities and our failures that one can't help agreeing that where'er we may roam,—"there's no place like home."



▼ The natives of New Zealand, the Maoris, spared no pains in applying their high skill as wood carvers in the decoration of their houses. The style of decoration in which they have distinguished themselves is illustrated here by one of their carved food storehouses, on exhibition in the American Museum of Natural History

FROG IN WINTER



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

NOT long ago people believed that when winter came the swallows dived down into the mud at the bottom of ponds and spent the winter sleeping there. This was pure fancy, of course. Swallows really go south to warmer regions where insects fly all winter. But it is a strange fact that frogs do spend the winter much like the swallows were supposed to do. They go down to the bottom of their ponds and bury themselves in the mud. Sometimes dozens of frogs are found in the same pond-bottom, lying closely packed like sun-bathers on a city beach in the summertime.

Frogs spend part of their time on land. They can jump along the shore or into the water and they breathe air, but they have not become fully suited to a life away from the water. The skin does not give much protection from drying; its outer horny layer is very thin. A frog will dry up and die in a little while if kept away from moisture. This is a drawback, keeping frogs close to ponds and streams, but it does allow them to spend the winter under water.

On land a frog breathes much as we do. It has no ribs or diaphragm so it must "swallow" the air, but the same exchange of gasses goes on. Carbon dioxide gas, produced by the chemistry of living, is given up, and the life-giving oxygen is taken in by the blood to be carried to the various parts of the body. In addition to the lungs, the skin of frogs permits this exchange of gasses, thus serving like an accessory lung. Just below the skin there is a network of blood vessels, and the thin, moist outer layer of the skin allows oxygen and carbon dioxide to pass readily. We cannot breathe through our skin this way, for it is relatively thick and waterproof—even the most delicate human skin has a good horny layer.

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Program of the American Museum of Natural History for January, 1945

WEDNESDAYS

over WNYC & WNYC-FM
from 3:30 to 3:45 P.M.

Science for the Seven Million

Conducted jointly by Lucy Clausen and Julius Postal

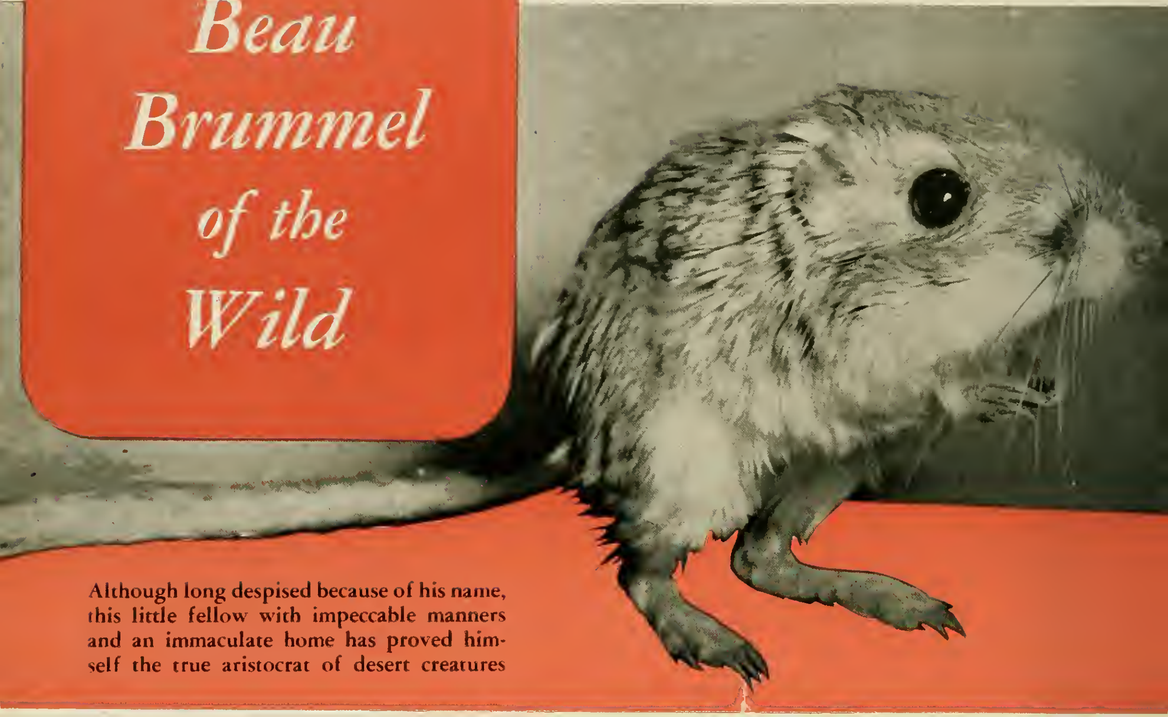
Jan. 3—*Science in the News*
Jan. 10—*Contract with Nature*
Jan. 17—*Food for Warmth*
Jan. 24—*Captive Heat*
Jan. 31—*Winter Camera Trip*

A frog can stay a long time under water, even in the summer. When the animal is hibernating, cold almost to freezing and with all its life processes slowed down, skin-breathing is sufficient.

One frog, the so-called hairy frog of the Congo region, is covered on the sides and thighs with slender threads of skin, densely set and almost an inch long! Each "hair" contains blood vessels that run near the surface. This frog "breathes" all the time by means of the strange skin-growths; it has only vestiges of lungs.

Beau Brummel of the Wild

By William M. Rush



Although long despised because of his name, this little fellow with impeccable manners and an immaculate home has proved himself the true aristocrat of desert creatures

It is unfortunate that many of our North American animals were given wrong names by the first settlers. The American moose is an elk; our elk should have some such name as gray deer, red deer, or the Indian name wapiti, which is sometimes used; and buffalo are really bison. But perhaps the most unfortunate mistake is to apply the name "rat" to the most beautiful and gentlemanly mammal on the continent, our native kangaroo rat.

Its scientific name is *Dipodomys*, which translates into English as "mouse with two feet." This is appropriate, as the animal travels on two legs at a gait known as "saltation," a series of leaps somewhat like the kangaroo.

The despicable brown rat which causes this country millions of dollars damage every year and transmits to us the dread diseases of plague and typhus, is an importation from Europe and Asia and deserves nothing better than complete annihilation. Dipodomys is as far removed from this slinking, hard-tailed, beady-eyed, destructive creature as white is from black. Dipodomys lives far from civilization in all the western states except Washington, thriving in the hottest, driest desert regions and causing mankind little trouble.

There are a dozen or more species, varying mostly in size and coloration. Sometimes two or more species are found in the same region.

I came upon a "kangaroo's" house in the Painted Desert of Arizona one fine spring day. He had made no attempt to conceal his home. It was built around a creosote bush of sand, gravel, and twigs. Its gray, white, and brown colors blended prettily with the bright green leaves, brown stems, and yellow flowers of the creosote bush. I hesitated to desecrate the home, but how else could I learn anything of its occupant? I was careful not to wreck it any more than I must, but even then I plucked away the sticks and scooped away sand and gravel with the feeling I was housebreaking.

There were tunnels running in several directions, mostly lateral and downward. There was more than one outside entrance, all plugged with sand to keep out intruders. I used a shovel to get down to living quarters. And there was another very good reason why the house of a desert rat should not be explored by the bare hands. Oftentimes rattlesnakes, particularly the sidewinder, take up their abode in some of the tunnels. Dipodomys is suspected of sealing them off from the outside world so that the snakes must die of slow starvation, but this needs confirmation.

I found several chambers partially filled with seeds and other food supplies. All of the rooms and runways were scrupulously neat and clean. All droppings had been carried outside, mixed with sand, and deposited on top of the house. Urination was done outside. From a hygienic standpoint the house was a model.

Curled in a remote corner was the only occupant. The beautiful little desert creature blinked his owl-like eyes at the unaccustomed brightness of daytime, for he is strictly a nocturnal animal. I picked him up. He did not attempt to bite or scratch as I stroked his fur but huddled in my hand. I set him down again. He reared on his haunches and fondled his tail. He stood about six inches high. Hind legs, more than twice as long as the front ones, set him three or four inches taller. His feet were furred, permitting him to travel silently on desert sand. His head was large, gnomelike, out of all proportion to his body but shapely, with big wistful eyes and rounded ears.

It is the color and pattern of his coat that earns for Dipodomys the title of Beau Brummel. Upper parts were reddish buff, the belly white. Black patches ornamented the base of his whiskers, a black bar struck across his nose. Black eyelids and blackish ears were set off by white around the eyes, white spots and bands around the ears, and a white band across the thighs. His long whiskers were black, the short ones white.

Dipodomys keeps himself well groomed. He is especially fond of his long tail, which is a beauty, eight inches long, black and white striped, with a white ring at its base and a tuft of richly colored brown hair at its tip. As I watched he held the tail in his forepaws and drew it across his mouth several times to groom it fastidiously. Then he dashed to an open tunnel and disappeared. This luxurious tail has a very practical value, as it acts as a balancer and rudder while Dipodomys is traveling fast. Without it he would be almost as lost as a boat without a rudder.

Hearing

Dipodomys' ears are well adapted for life under as well as above the ground. Above ground they appear relatively small but shaped to catch every sound. Inside the skull are large auditory chambers of very thin bone occupying about half of the total skull space. These are supposed by some to act as ear trumpets to magnify the slightest sound or vibration that comes through the ground.

Such a seismograph is also a feature of other ground-living animals, of which pocket gophers and pocket mice are examples. This is the reason for the owl-like heads, out of proportion to their bodies.

Although Dipodomys looks like the jerboa of Egypt and Asia, it is not related. In the hind legs of both jerboa and Dipo there is a single bone below the knee instead of two as in ours. But jerboas have only three toes, whereas our kangaroo rat, which has progressed less far in the scale of evolution, has five on each foot. (Some species have only four toes on the hind feet.) Jerboas were a favorite article of diet with the Tartars when they overran Russia in the thirteenth century. There is no reason why Dipodomys would not be excellent food, were he not called "rat."

The food of Dipodomys is chiefly seeds, although he eats green forage on occasion. Underneath his black and white whiskers are capacious pouches, which he uses to carry food.

One evening in late August, from the top of a large flat rock in northwestern Nevada, I watched a kangaroo rat gathering food. He came out of his house shortly after sundown, peered all around from the top of a mound for a minute or two for possible enemies before venturing away from his underground fortress, then jumped on hind legs, several feet at a jump, to a clump of bunch grass, never touching front feet to the ground.

Standing erect, the little fellow again looked around to satisfy himself that all was safe, then began to gather seeds and stuff them into his food pockets. He worked quickly, moved on to another clump of grass, and from there went out of sight.

It was almost dark when he came flying back, in leaps two feet high and six feet long, tail streaming out behind like a banner. A prowling coyote had disturbed his evening labor. At the house he dived inside without a moment's pause. He had no more than disappeared when the gray dog of the prairies came along, nose to the ground. He tracked his quarry to the underground house but did not try to dig it out. Perhaps the coyote was afraid of digging down on a sidewinder.

Dipodomys has for enemies every nocturnal meat-eating animal of the desert country. He does not venture abroad in daytime so is safe from hawks, but owls keep a close watch and swoop down on him with beak and talon whenever they get a chance. His only defense from owls is quick escape under some spiny bush. Coyotes, foxes, weasels, and bobcats slink through the cacti, sagebrush, and mesquite to kill and eat as many of the little seed-gatherers as they can catch away from thorny retreats or underground refuges.

Snakes, however, are possibly the worst enemies. The desert sidewinder has two methods of hunting kangaroo rats. One is to lie in wait where the little dandy is sure to come for food and strike him down. No other animal can do this with success. And any creature that attempted to sneak up on Dipodomys might as well be a locomotive as far as sounding a warning is concerned. The sidewinder's other method is to crawl inside the dandy's house and wait until its occupant comes home.

Dipodomys' defense is quick retreat. His super senses of sight, hearing, and smell give him warning. If he acts quickly enough he lives. Otherwise he is a dead dandy.

Lively fighters

A friend of mine has some pet kangaroo rats. They love to be fondled and never attempt to bite or scratch unless roughly handled. But sometimes they fight one another, clinching with forefeet, kicking and scratching with hind feet, slashing with teeth. Their fights often result in the death of one and sometimes both antagonists. A wheel inside their cage gives them amusement and exercise. They love to play. Unfortunately they are nocturnal and do most of their playing at night. Daytime is sleep-time for them.

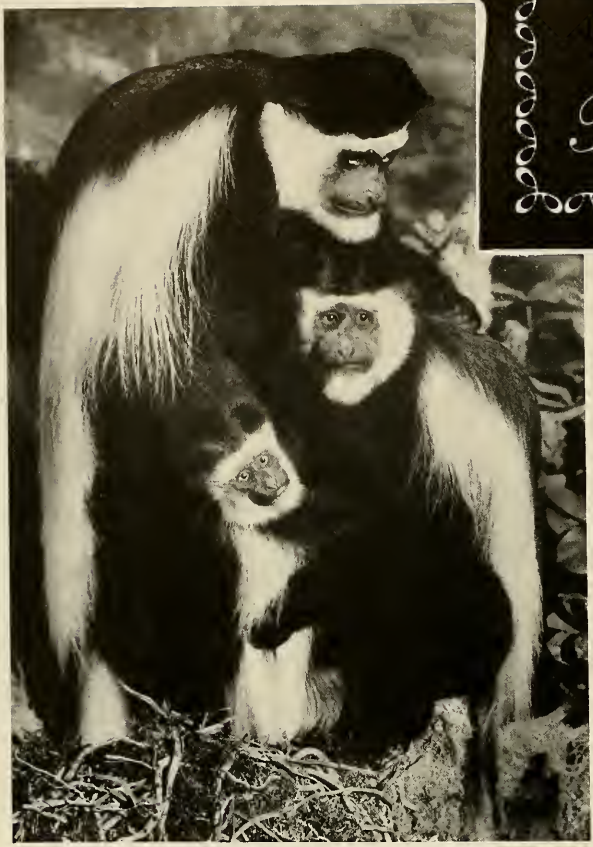
In the wild state the young are born from early spring to late summer. In confinement there is no set time as food is always abundant, but very few kangaroo rats have been born in captivity. There are two, rarely three or four, in the litter. The young are born naked and blind and are carefully cleaned and attended by the mother. She is devoted to them and will fight to the death in their defense.

Father Dipodomys gives his family little attention after mating.

When the young are a week old, whiskers begin to show; in about eleven days teeth appear. In sixteen days, when the eyes open, the color pattern is distinct. When 20 days old they play with one another; at 25 days they collect food in their seed pouches. At two and a half months they are almost grown, and at four months they are about as large as they ever will be. The period of gestation is 21 days. With care they live three years or more as pets.

A check on the capacity of the kangaroo rat's cheek pouches shows that they can hold more than a teaspoonful each. Six hundred trips with

Continued on page 44

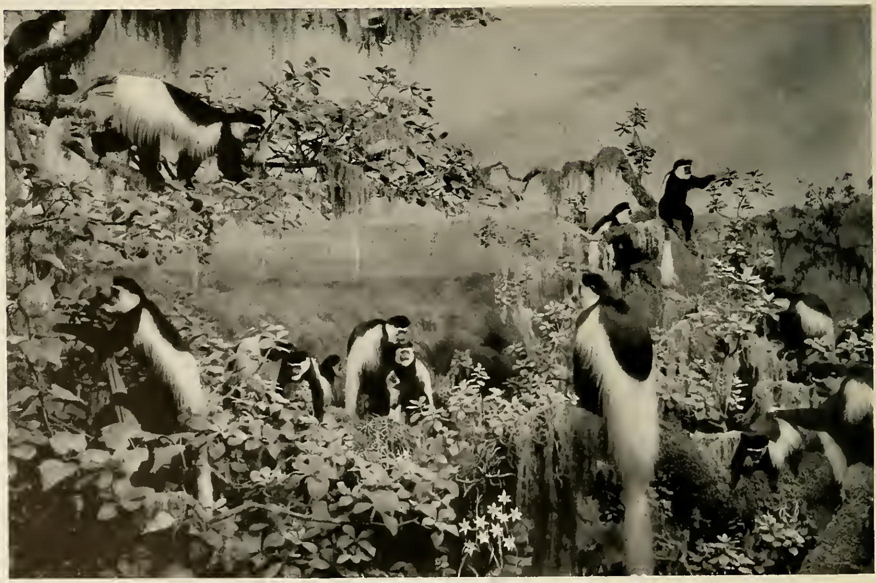


THE COLOBUS Family Album

A difficult journey and much patient observation would be necessary to see anything like these scenes of Colobus family life, exhibited in Akeley African Hall in the American Museum of Natural History. These beautifully patterned monkeys live almost entirely in the trees. Since they remain far from human habitations, they are rarely seen; and they do not survive long in captivity. Their range includes most of the forested regions of Africa.

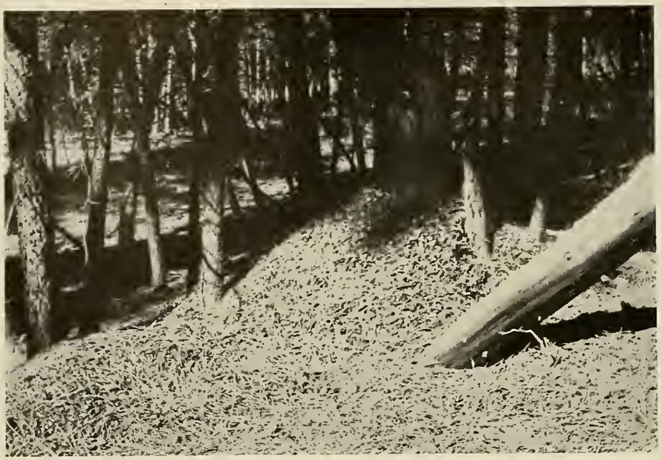
Colobus monkeys feed chiefly on leaves of trees, also probably on fruit; and they have developed specialized teeth and a specialized stomach, adapted to this diet. The young are almost pure white. The long, silky black and white pelage is used in the fur trade and by natives for ceremonial adornment. Measures for the protection of the Colobus monkey have been taken by international agreement.

A.M.N.H. photographs



LETTERS

Continued from page 1



SIRS:

Can you give an explanation for the heap of pine scales shown in the accompanying photograph?

The pile was nearly symmetrical and cone-shaped. It was about four feet in diameter at the base, two and one-half to three feet tall, and contained about four bushels of scales . . .

This heap of scales was built around an old decayed stump, dimly seen in the photograph. The top of this stump was covered with seeds from the scales . . .

Near the base of the pile was a hole about two inches in diameter, which seemed to connect by a short tunnel to a cavity under one of the decayed stump roots . . .

Several Fremont Chickaree were observed in the area, and I suppose they were the constructors of the heap; but why the size, compactness, and symmetry of the formation? This was absolutely the only accumulation of any kind of scales within several hundred yards, as far as we looked.

BILL R. EASTMAN, JR.

Douglas, Wyoming

The heap of pine cone scales and cores is without doubt the midden heap of a chickaree, or Fremont red squirrel, although of exceptionally large dimensions. Occasionally even larger heaps are formed, the accumulations of many years.

The squirrels sit on the stump to work over the cones, and the refuse drops in different directions by chance. This leads to symmetry in the pile. Probably several squirrels use the stump, and it is evident that the pine cone crop was a good one.

The holes are burrows made by the chickarees in their refuse heap, probably as shelter holes to escape possible hawks.

JOHN ERIC HILL,

Assistant Curator, Recent Mammals,
The American Museum
of Natural History

SIRS:

What a privilege it would be to hear your remarkable duet—the singing mice and the musical alligator! But, laying aside all tempting facetiousness, let me say that there is no magazine that I recommend so whole-heartedly to my classes in Biology and Nature Study in Boston University as NATURAL HISTORY. So often I use the pictures in projecting machines and speak specially of the valuable information which you gather for us and send to us each month. Thank you!

EARLE A. BROOKS.

Newton Highlands, Mass.

* * *

SIRS:

. . . I am 95 years old . . . and do not write letters very often. I want to have the Magazine as long as I live. If I forget to renew, please remind me.

ELEANOR FROST.

Hanover, N. H.

* * *

OTHER COMMENTS:

". . . the Magazine of Magazines. . . ."

"Every copy of the Magazine is a pleasure to me, and as long as I can half-way spare the money I would not like to miss it. . . ."

Correction

The George Fuhriman Well *did* give both fresh and salt water as described in the December issue of NATURAL HISTORY. But it did *not* issue in separate States. The well is at Rapid River, Michigan, as indicated on the diagram, not at Rapid River, Wisconsin, as inadvertently stated in the text. No reader, strange as it may seem, has called this additional "marvel" to our attention as the current issue goes to press.—ED.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

BEAU BRUMMEL OF THE WILD

Continued from page 41

loaded packs would equal a bushel. It may take all night for him to cram them full of seeds but he can empty them in a fraction of a second by a forward movement of the front paws. This ability to dump his load quickly is of great value in making a quick getaway from his enemies.

Dipodomys breeds prodigiously. He lives an independent life away from civilization. His natural enemies are legion yet he manages to outwit them and survive in plentiful numbers. In some localities he becomes a nuisance on cattle ranges.

An old bow-legged cowboy in Nevada came in one night with a face full of spines and a skinned nose.

"My hoss stepped into a gol-danged rat's nest when I wuz runnin' some dogies and spilled me in a prickly pear!" he raged. "What danged good are them rats, anyway?"

I didn't tell him that they might be delicious food if they were called by another name, or even that such beautiful and interesting little animals were worth saving as an object of natural history. Every naturalist knows that there are times when it isn't wise to defend a wild creature, no matter what its virtues. And this was one of those times.

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SPARKLING HIGHLIGHTS

By THANE L. BIERWERT

Acting Chief, Division of Photography, American Museum of Natural History

THE children love it. The apartment house superintendent hates it. The sportsman enjoys it. The Department of Sanitation prepares for it. The truck driver dreads it. The photographer can't wait until it comes. What is it? Snow.

When the snow does come, be ready for it: know what to wear, what films and filters to use, and how to photograph subjects to best advantage. First of all, take a tip from the skiers and cold weather explorers: wear outer clothing that is closely woven and wind-proof. In handling the cold metal parts of the camera, protect your hands with thin gloves of cotton or wool, reserving heavier gloves for the longer spells between shots. If you have sun glasses, wear them too, but don't judge the picture possibilities through them. A filter may be needed to achieve the same effect.

Cameras do not enjoy cold weather. Shutters become sluggish, changing the timing because the metal contracts, the oil congeals, and the rubberized cloth of the focal plane shutter hardens. There is a remedy: keep the camera under your jacket when not in use. If it still sticks, limber it up by tripping the shutter a few times with your hand over the lens. If very much cold weather photography is planned, have "your oil changed" to the new high altitude aerial camera oil developed during the last few years. Never try to clean the lens in below freezing weather by blowing on it.

In wintry weather when a camera is brought suddenly into a warm room, moisture rapidly condenses on the lens and metal parts. Photographic equipment should therefore be protected from sudden temperature changes.

Snowscapes are not easy to photograph. Some experts say that we should use long scale, soft-working films, such as Super-XX or Ultra-Speed Pan. Others state that we should overexpose and underdevelop our negatives, using a contrastier film like Panatomic-X or Superpan Supreme. Who is right? Be your own expert, select the film that you like, and master it. With most color films, you can control only the exposure, for the development is out of your hands. More important is what you see to photograph, how you photograph it, and whether or not the finished result is what you wanted it to be.

If you are a beginner in snow photography, try this experiment and judge for yourself which picture produces the best result. Go out on a sunny day after a snowfall. Look for some animal tracks running near evergreen shrubs or tree trunks. Photograph that area "around the clock," with and against the sun, cross-lighted, with and without filters, and over, under, and normally exposed. Keep a record of each exposure. When you view your prints or slides, compare them for detail in the high-light areas of the snow in each picture. Compare likewise the detail in the shadows and note what effect the filters had. See which angles brought out the crystalline texture of the snow to best advantage, and which gave the best composition and perspective. This experiment carried out to completion and carefully analyzed, will prove more educational than six articles and eight lectures on how to make excellent snow scene exposures.

A book could be written about winter subjects and how to photograph them. Several basic suggestions are all that space permits here. When beginning snowscape photography, work in large tonal areas. Use dark areas to carry out lines of composition. The deeper blue the sky is, the lighter the filter necessary. Make prints with plenty of sparkle in the snow; overaccent the contrast if necessary. When shooting color, look for blue and violet shadows to lend interest and increase color-consciousness.

When photographing people, expose for the faces and let the rest of the scene take care of itself. Snow-covered fields, ice-covered streams, snow-laden bushes, tracks in the snow, sporting scenes, close-ups, and whole mountain sides can all be successfully pictured when once we learn what and when to photograph. Even overcast and stormy days offer possibilities for pictures to show atmosphere.

There will be days when we do not make a single exposure, but we will have had a marvelous time tramping through the snow. It is the change we need after a week of indoor work: invigorating air, mild exercise, mental freedom, and relaxation.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

PHOTOGRAPHIC EXHIBIT

All nature photographers are cordially invited to submit their four best prints to the Seventh International Salon of Nature Photography at the Buffalo Museum of Science. The photographs selected will be exhibited from May 16 through June 12 at the Buffalo Museum of Science.

Six classes of photographs will be considered, as follows: (1) Mammals, (2) Birds, (3) Plant Life, (4) Scenery, (5) Miscellaneous, and (6) Color (not hand colored).

Complete conditions appear on the entry form, which is available on request. A non-returnable entry fee of one dollar must be sent with the entry form. The closing date is May 13.

AWARD

At the tenth anniversary meeting of the American Polar Society, held at the American Museum of Natural History on December 5, Lincoln Ellsworth received the illuminated scroll emblematic of Honorary Membership in the Society. It was only the fourth time in the history of the American Polar Society that the award had been made. Mr. Ellsworth, who is a Trustee of the American Museum, has made seven expeditions to the polar regions and is the only person who has crossed both polar ice caps.

Previous recipients of the award are Brig. Gen. David L. Brainard, U.S.A. (Ret.), Rear Admiral Richard E. Byrd, and Dr. Vilhjalmur Stefansson.

In his address, Mr. Ellsworth emphasized the potentialities of the Antarctic and announced his intention of establishing a permanent weather station on the fog-bound coast of James W. Ellsworth Land.

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THE WOLVES OF MOUNT McKINLEY

- - - - - - - - - by Adolph Murie

Fauna Series No. 5
U. S. Gov. Printing Office, 40¢, 238 pages

THIS is a scholarly study of the wolves in Mount McKinley National Park, Alaska, and is one of the best statements of its kind that this reviewer has seen.

For some time there has been widespread concern over the status of wolves and coyotes in Alaska and the depredations they might be causing upon the wildlife there. The National Park about Mount McKinley was used as a test area for the study of the wolf and for those species upon which it preys. In order to secure all of the data before passing judgment upon the wolf, it was necessary to make first-hand observations of all the ecological associations centered about the wolf.

The author, therefore, gives not only a very full and convincing account of the life history of the wolf but also has chapters on the Dall sheep, the caribou, the moose, the grizzly bear, the red fox, and the golden eagle. In all of these pages he draws upon the recorded observations of others but adds immeasurably from his own exceptional background of intimate acquaintance. He has spent long periods of time with all of his attention directed toward securing these facts. As an example of this application he writes: "Between May 15, when the den was discovered, and July 7, when the wolves moved a mile away, I spent about 195 hours observing them. The longest continuous vigil was 33 hours, and twice I observed them all night."

After providing the reader with a splendid background, the author summarizes his conclusions, which seem well justified by the evidence. He finds the wolf preying largely upon the Dall sheep and the caribou, both of which appear to be able to stand the consequences. The animals killed by the wolves are largely the young and the old or diseased individuals. The sheep and the wolves may now be in equilibrium, but it is apparent that the wolf is the chief check on the increase of the sheep within the Park. The caribou has maintained itself in the presence of the wolf over a long period of time, and if wilderness conditions prevail there is no reason why the wolf-caribou relationship should not continue as in the years before man appeared upon the scene. If man should himself become an extensive check on the caribou, it may be necessary to revise the degree of tolerance given to the wolf.

Regardless of whether the sympathies of the reader are with the sheep, caribou, and other so-called game species, or the wolf, which is frankly described as a predator, he will find Murie's report indispensable to an understanding of the problems. The reviewer cannot praise to highly this splendid piece of natural history reporting.

H. E. ANTHONY.

THOMAS JEFFERSON AND THE SCIENTIFIC TRENDS OF HIS TIME

- - - - - - by Charles A. Browne

Chronica Botanica Company, $1.25
61 pages, 12 illustrations

THE recent bicentenary of the birth of Thomas Jefferson has been the occasion for extensive review of the qualities and accomplishments of that great man. He was, as has been made abundantly clear, a sort of universal genius whose interests ranged over the whole field of human knowledge and activities. Such breadth is unique among presidents and rare among men.

Most of the recent publications on Jefferson have been mere eulogies. This pamphlet seriously attempts to evaluate Jefferson's scientific activities in the light of contemporary knowledge and of later history. His interests were, indeed, universal, but his personal and original contributions to science, important as they were, have often been exaggerated.

Jefferson was, above all, an organizer and a stimulater of scientific work. His sponsorship of the Lewis and Clark expedition, his founding of the University of Virginia, and his presidency of the American Philosophical Society were outstanding, enduring, but indirect contributions to science. Original work was, however, not lacking. Most notable are his invention of a new plough and his "Notes on Virginia," a geographic study strongly suggestive of the later and much more extensive "Kosmos" by Jefferson's friend Humboldt. Both his public and his private occupations focused much of Jefferson's attention on agriculture, a subject on which he thought and wrote much, while making practical applications on his own estates of the observations and theories of many other students of the subject.

It is clear in almost all his contacts with science that Jefferson was, above all, utilitarian. He was inclined to deprecate pure or theoretical science as mere speculation. He underrated the most progressive scientific (as opposed to technological) developments of his day and often clung to concepts that were already becoming outmoded. His own relatively few attempts at theorizing had no lasting value and, indeed, serve only to reveal that in the realm of the abstract he lacked insight and judgment.

Jefferson's genius was for the concrete, and his true role in the history of science is more as patron than as actor.

G. G. SIMPSON.

NATURE ENCYCLOPEDIA

Edited by G. Clyde Fisher; five volumes bound in De Luxe Green Keratol lettered in Gilt. pages are 5⅜ x 8 inches. Lives and habits of Birds, Mammals, Fish, Reptiles. Flowers and Trees: described by renowned Naturalists; 700 illustrations, 200 in Natural color. The Literary Mart, 8 East 33rd St., New York 16, offers this set for $6.00, remittance with order, returnable for full refund within five days.

THAT VANISHING EDEN

- - - - - - - by Thomas Barbour

Little Brown and Co., $3.00
25 illustrations, 250 pages

IN his new book, Thomas Barbour describes "A Naturalist's Florida;" thus, in a very inclusive sense he writes of mounds, Seminole Indians, forests, drainage, sponges, mammals, the Fairchild Tropical Gardens, and the Everglades National Park.

It is written for popular consumption with such a keenness of observation and freshness of description that the reader as well as the author, becomes eager to further the constructive development of Florida and prevent the destruction of her resources. This well-known naturalist imbues the layman and scholar with his enthusiasm for continuing the "diggings" of Florida's prehistoric and now observable bones, while the chapter entitled "Ditches" gives a true picture of a flower-carpeted heaven of today.

The original material is so good that it is unfortunate that such long passages are quoted verbatim from Bartram, Small and Willson. The Seminole Indian situation is well presented. It is only the secondhand information that is incorrect. Contrary to Doctor Barbour's statement, tribal laws and punishments are rigorously, though secretly enforced, for fear of unjust white interference, and Seminole culture has changed surprisingly little. Mortars and pestles are not things of the past, and sifting baskets are still being made. The author was misinformed in a number of other cases as well, but these are things of minor importance. With the growth of Florida, it is pointed out, the future of the Seminole Indians must be given special consideration.

The book is altogether agreeable and ends on a constructive note. We visualize the conservation of our native flora and fauna in the proposed Everglades National Park and the expansion of our national resources by increased food and plant production in the 'Glades area. But we cannot overestimate the great value to our country of the suggested experimental laboratories in South Florida. Primitive Eden may vanish, but the possibilities of great developments lie ahead.

ETHEL CUTLER FREEMAN.

COMPASS OF THE WORLD

A Symposium on Political Geography

- - - Edited by Hans W. Weigert and Wilhjalmur Stefansson

The Macmillan Co., $3.50
466 pages, 39 illus.

IF Americans have had to learn the hard way that there are certain inexorable geographic facts that govern the conduct of war, they must also awaken to the significance of geography in maintaining the peace. Perhaps the most dramatic evidence of this necessity is the use of airplanes and airways that have brought near to us places we thought were far. There has been a revolution in our orientation in the world and we must appreciate it to understand the advantages it brings us as well as the dangers that may beset us.

It is the purpose of this symposium of 28 pages by almost as many authors to bring home to the public the meaning of geography in the world of tomorrow. Although the various papers are not as well knit into as co-ordinated a whole as one might expect from a single author, they compensate for this lack of sharply focused continuity by presenting a wide range of topics and a nice assortment of authority. Here are critiques of Haushofer's geopolitics, the significances of the airplane in laying down new directions of world orientation, the role of continental land masses, the influence of climate upon population movements, the emergence of once neglected areas, the northward course of power, Siberia and the Soviet Arctic in the future world, and the importance of population differentials in world affairs.

We have gone beyond the point where is was a genuine discovery to proclaim that we all belong to "one world." We must learn to live in it. *The Compass of the World* offers us some enlightened views on what we face.

H. L. S.

THE AZTEC AND MAYA PAPERMAKERS

- - by Victor Wolfgang von Hagen

J. J. Augustin, $6.00. 120 pages, 39 plates

THE history of the manufacture and use of paper is a fascinating subject of study. In the Old World its history is closely linked with the development of modern civilization, and, although the use of paper never achieved comparable importance among the New World cultures, it had a curious development here which anyone interested in the subject will not care to overlook.

The story is brought together for the first time in this attractive and well illustrated book. The American Indian never made a true paper molded from fiber pulp, but a very similar product was obtained by extending the interlaced fibers that exist in the inner bark of various species of American fig trees. Paper of this kind was extensively used by the Mexicans and the Mayas in the making of books or codices and for various ceremonial purposes. The Aztecs collected a tribute of 480,000 sheets of paper annually from their subject tribes. The same material is still used in Mexico and Central America for purposes of witchcraft and for clothing, and a full account and illustration of the present day techniques of manufacture forms a valuable portion of Mr. von Hagen's study.

This book is clearly designed for the general reader, but it is nevertheless a real contribution to American archaeology and history. Besides bringing scattered material together into easily accessible form the author clarifies one misconception that has been current in the literature since the nineteenth century. He shows that Aztec papers were all made from the bark of the fig tree and never from the leaves of the maguey plant. The final chapter is a description of the American fig trees by Paul C. Standley, pre-eminent authority on the trees and shrubs of Mexico.

There are some unfortunate errors in the book, such, for instance, as the caption to plate 4a (the building shown is at Chichen Itza and not at Uxmal) and the ambiguous caption under the map opposite page 12 which partially indicates that American papers were derived from those of the Old World. Nevertheless the book is a valuable addition to the literature on the American Indian and one that will receive wide recognition.

G. F. EKHOLM.

THE CONSERVATION OF NATURAL RESOURCES

- - - - - by H. Basil Wales and H. O. Lathrop

Laurel Book Co., 554 pages, 204 illus.

MOST parts of this book are of unusual merit. It contains much more instructive and useful matter about the conservation of our resources than one could expect to find in a volume of such compartively small size. It is very well written, and good judgment is shown in allotting space to the different subjects and in emphasizing the important matters; and it gives testimony to the knowledge and ability of its authors and their careful work in planning and perfecting it.

The authors confine themselves to the teaching purpose of the book, describing the present conservation work and methods going on in the United States and indicating how it can be increased and made more effective. Matters of past history are briefly passed over or omitted, and few statistics are given, which reduces its value as a reference book but permits more thorough consideration and discussion of conservation methods and practices.

One feels apologetic in finding any fault with so good a work, yet it is open to some serious criticism. Anti-National Park propaganda such as the following should not have been permitted in it:

"When people generally understand that forest management does not mean forest destruction, and that a managed forest can be just as beautiful and inspiring as a natural one, public opinion may decide that the waste of timber in public parks cannot be tolerated."

Such fallacious statements are especially harmful in a work otherwise so excellent and reliable. A moment's reflection will make clear that a managed forest cannot compare in beauty and attractiveness with a natural one, as the chief characteristic of a managed forest is that the large trees which would give beauty

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and grandeur to the natural forest have been cut and removed. Neither is it true that the timber in the parks is being wasted. Under the care of the National Park Service the forests in them are improving in quality and not wasting away. And fortunately the public knows that were the park forests to be subjected to management for timber production, all the magnificent trees that now delight the millions of visitors would quickly disappear. There are no indications that the public would tolerate anything of the kind. The park forests contain much less commercially valuable timber than is generally supposed and are of minor importance economically.

Although plywood has become one of the most important and constantly increasing uses of wood, and is one which may impose important modifications on forestry practices and policies, owing to the large and fine logs required for it, the word "plywood" does not even appear in the index of the book and plywood is barely alluded to in the text. It is hard to explain such an omission.

However, only very few reasons for such criticisms are to be found in the book, which can be highly recommended both as a school textbook and to the general reader interested in conservation.

WILLARD G. VAN NAME.

A SHORTER HISTORY OF SCIENCE

- - by Sir William Cecil Dampier

The Macmillan Company, $2.00
189 pp. New York

SIR WILLIAM CECIL DAMPIER, Sc.D. and Fellow of the Royal Society, has done a welcome thing in giving us an abridged and condensed edition of his monumental work, *A History of Science and Its Relations with Philosophy and Religion,* which has already gone through three editions.

This newly written work, a compact little volue, is an achievement. In eleven short chapters, the author has told the story of the development of the physical sciences from the very beginning, as well as that of the biological sciences. It has been written with a feeling "that early specialization is dangerous, an opinion which leads to a desire to give even scholarship candidates a well-balanced education."

Beginning with prehistory, based upon archaeological evidence, the author traces origin and development through the dawn of history in Egypt, Babylonia, China and India, Crete and Mycenae. "Some anthropologists," he says, "regard magic as leading directly to religion on one side and to science on the other, but Frazer [*The Golden Bough*] thinks that magic, religion, and science form a sequence in that order." In discussing the Greek religion, he remarks, "As Xenophanes recognized as long ago as the sixth century before Christ, whether or no God made man in His own image, it is certain that man makes gods in his."

Following is a swift-paced account of Greek and Roman science and philosophy, including the work of Thales of Miletus, Aristotle, Archimedes, Hipparchus, and others of the ancient world. The reasons for the stagnation during the Middle Ages are set forth. The Renaissance with Leonardo da Vinci and Copernicus forms a fascinating chapter, but none more interesting than the following one on Galileo and Newton. The author then follows the course of the various sciences through the eighteenth and nineteenth centuries, and down to the present day with the new physics and chemistry.

We have here a very readable little volume, written by one who lectured for many years in Trinity College, Cambridge.

CLYDE FISHER.

CLIMATE AND THE ENERGY OF NATIONS

- - - - - - - by S. F. Markham

Oxford University Press, $3.50
236 pages, 23 maps and charts

WHY are some nations centers of culture and progress while their contemporaries either stagnate in mediocrity or decline into a condition little better than savagery? Why does civilization move from one center to another, leaving one trail that begins in Egypt and passes successively through Crete, Asia Minor, Greece, Rome, Constantinople, Italy, France, the Low Countries, and England? These questions and countless variations of them have perplexed many minds and have yielded many answers.

Historians like Gibbons offer political and historical explanations. Other interpretations emphasize economics or sociology or invention of martial prowess. Race too has its protagonists. Some rely on a kind of super-organic analogy by which nations are compared to human life cycles with a youth, a middle age, and a senility. Recently we have had cogent arguments based on soil exhaustion and erosion. Even the lowly louse has been evoked as a *causa causans* of the fate of nations. In *Climate and the Energy of Nations,* Mr. Markham lays his money on climate, and makes out an excellent case for it. He points out that as individuals our energy output is strongly influenced by the state of the weather. On hot, humid days most of us are prostrated and have little inclination to exert ourselves. On cool days we feel fine and ready to go.

If this is true for us as individuals why is it not equally applicable to us collectively as a people or a nation? The author points out, in fact, that the high civilizations of today are distributed precisely in the areas where optimal climatic conditions exist. If we consider the problem historically, we find, as Mr. Markham explains, that civilization has moved northward into more bracing climates because we have discovered how to cope with them and still be comfortable. England, for example, was unable to harness her energizing climate until she had developed or borrowed the hypocaust system of heating (the hearth and chimney) which enable Englishmen to think of other things than merely how to keep their fingers from freezing. Air-conditioning the author sees as an extraordinarily significant means of distributing the benefits of good climate in regions now at a disadvantage and of improving the all year round conditions for all.

There is much pregnant thought in this book, and whether or not one accepts the universality of the climatic explanation, one must reckon with it as an important factor in civilization.

H. L. S.

THE NATURAL HISTORY AND BEHAVIOR OF THE WESTERN CHIPMUNK AND THE MANTLED GROUND SQUIRREL

- - - - - - - - by Kenneth Gordon

Oregon State College, 75 cents, 104 pages

THIS hundred-page study contains much interesting and original material as well as a survey of the work of others. Illustrations by the author supplement the text. About half of this consists of observation on the biology and ecology, the other half is an account of the behavior, both observed and experimentally tested in the field. The wild rodents, motivated by food, solved mazes, undid latches, turned discs, and pulled strings.

Many suggestions for studies of similar nature are to be found here.

J. E. H.

THE CONDITION OF MAN

- - - - - - - - by Lewis Mumford

Harcourt Brace and Co., $5.00

THIS is the third book in a trilogy appraising modern man. In his first book, *Technics and Civilization,* Mr. Mumford considered man's material culture and the technology of modern times. In his second, *The Culture of Cities,* he surveyed the way we live, our communities, our sociology if you wish. Now in the present volume, his subject is the spiritual values of man. In all societies and in all times, men live and die, they marry and beget children, but the ideals that they seek, the utopias they crave, the values that give meaning to their existence vary and change. But not without a sequence and a logic. The events of two thousand years ago touch our lives very closely, just as what we do today will affect those who follow us. The historical continuity of the human drama is very vivid and real to Mr. Mumford, and in this as well as in the other volumes of his trilogy he explores deeply into the past to find the clues for the present. There are few Americans writing today with more scholarship and with a greater understanding of the historical process.

I cannot attempt in a brief notice to begin to give the flavor of this fascinating book. It covers a long span in western civilization by means of masterly summations of successive periods. It traces the growth and disorganization of the human personality. It sets man against his spiritual environment and seeks to explain the condition in which he finds himself at the present time.

Even if one does not agree with all of Mr. Mumford's interpretations, it is a book that is rich and rewarding.

H. L. S.

February **NATURAL HISTORY** 1945

Wissler: Corn and Civilization · Paper-Making Wasp

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BIRDS OF NORTH AMERICA

MORE than half a century ago Rex Brasher set out to paint all the birds of North America. Wandering across the continent and sailing up its coasts, he spent fifteen years sketching and studying birds and the settings in which he found them. Combining this scientific observation with a distinctive artistry, he finally completed his collection—874 pictures depicting more than 1200 birds against their natural backgrounds.

Then, when Mr. Brasher found that he could not have his paintings reproduced in all their glorious colors, he colored 100 sets of them by hand. Complete records of North American bird life, these 12-volume collections were quickly purchased, and the originals became the property of the State of Connecticut.

We cannot all spend a lifetime outdoors, recording our own views of nature, and few people were fortunate enough to obtain Mr. Brasher's 12-volume groups. Now it is possible, however, to buy single reproductions, and frame a small section of the North American scene within your home.

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LETTERS

SIRS:

Last summer a crowd from Sigourney, Iowa, went on a picnic to the classic Skunk River. When we arrived at our destination, I walked into a pasture with tall blue grass and buck thorns and came to a circle of buck brush (as we call it). To my surprise, on the other side of the brush were eight little young garter snakes, about 12 or 13 inches long, with their heads about three inches up in the air. They were weaving in and out, passing each other, and making a calling noise. The old snake was lying under the buck brush. The little snakes kept up this dancing or whatever you might call it, until one of the crowd came bolting up and scared them. You would never have known there was a snake in the whole pasture.

I am wondering whether this is where the American Indian gets the idea of the Snake Dance. . . .

(MRS.) H. I. SCHIPFER.
Sigourney, Iowa.

The following comments on Mrs. Schipfer's observation are given by the Curator of Amphibians and Reptiles at the American Museum of Natural History:

The observations on garter snakes reported by Mrs. Schipfer are interesting, but I cannot interpret them with certainty. When garter snakes mate there is a courtship that often consists in the male's passing over the female and then pausing as she moves on. When one or more competing males is on hand the general appearance of the snakes is of their bodies weaving in and out. But ordinarily the heads are not held high. Usually the male attempts to rub his chin along the back of the female, and presumably he is stimulated by such contact through special sense organs on the chin.

In any event the snakes described by Mrs. Schipfer supposedly were too small to be mating. It is possible that what she saw was a brood of young garter snakes recently brought into the world by the larger snake observed under the buck brush. In garter snakes the eggs are retained in the body of the parent until they are ready to hatch. When first expelled the young snakes are encased in a transparent capsule or membrane from which they emerge immediately. Shortly thereafter they shed their skins, a process that involves some crawling about, since a slight amount of friction is required to break the skin at the tip of the snout. Because a hiss is the only noise that a garter snake can make, beyond that involved in the rustling of the coils when the lungs are inflated, the "calling" must be attributed to some other animal.

On the other hand, it is not impossible that the snakes were actually adult Dekay's snakes carrying out their normal courtship. This smaller species could easily be mistaken for the garter snake, and the behavior of Dekay's snake while courting has never been described. Perhaps the head is raised,—as it is in some species.

A third possibility is suggested by observations made on a brood of Texan patch-nosed snakes in the laboratory. When this brood was permitted to bask in the light and heat provided by a photoflood lamp, several of them rested on the sand with their heads raised while a progression of waves traveled from the head to the tail. Some small racers in the same cage failed to perform in this remarkable fashion, and I cannot advance any theory that would account for such behavior in the patch-nosed snakes.

Thus the snakes seen by Mrs. Schipfer could have been courting, shedding their skins, or merely undulating their bodies for unknown causes. Personally I would doubt whether observation of the nuptial behavior of snakes contributed any notions utilized by Indians in their ceremonials. The Snake Dance of the Hopi Indians is intricately woven with their mythology and religion, but so far as I know, snakes are involved in the symbolism of the ceremony only in that they are regarded as messengers to the tribal divinities. The ceremony is known as the Snake Dance because the participants carry the ophidian "messengers" rather than because of any imitative behavior on the part of the dancers. However, students of the American Indian may have additional knowledge never brought to my attention.

CHARLES M. BOGERT.

* * *

SIRS:

Having just read in your last issue the article on the Eagle, I thought an incident which I witnessed some time ago might be of interest.

I was approaching a water hole on my cattle ranch near Chowchilla, California, when I saw a large bunch of Gray Geese in and about the watering place. The geese seemed to be nervous but did not at once take to the air. I then noticed a large Bald Eagle sitting on the fence at the end of the pond. When I had ridden to within about one hundred feet of the geese they arose from the water. Immediately the eagle darted among them and seized a goose behind both shoulders and flew off with him, going about a quarter of a mile. I followed, and the eagle again took off with the goose but for a shorter distance. As I again approached, the eagle rose into

Continued on page 94

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President — ALBERT E. PARR, Director

VOLUME LIV—No. 2 ★ ★ ★ ★ **FEBRUARY, 1945**

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THE COVER THIS MONTH

The scarlet, curved-billed bird displayed on the cover of this issue of NATURAL HISTORY is the Iiwi of the Hawaiians, named *Vestiaria coccinea* by Forster, the naturalist in Cook's party who discovered the Hawaiian Islands. It belongs to the Honey Creepers (Drepaniidae), a family which provides a most interesting case of divergent evolution. The family is restricted to the Hawaiian Islands, and all its members have probably descended from a single goldfinch-like ancestor. Yet the specializations in their bills range from a short, stout, almost parrot-like form to an extraordinarily long, curved, sickle-shaped organ. Eight different species of honey creepers are displayed in the exhibit in Whitney Memorial Hall from which this photograph is taken.

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YOUR NEW BOOKS

WOMEN AND MEN • CURRENTS AND EDDIES
AMPHIBIANS AND REPTILES • WOODCOCK

WOMEN AND MEN

by Amram Scheinfeld

Harcourt Brace & Co., $3.50
40 line drawings, 453 pages

MR. SCHEINFELD could hardly have chosen a subject of more general interest than this. Men and women have discussed and disputed from time immemorial and on all levels of emotion the basic differences between themselves. Almost every conceivable human failing or virtue has been attributed to one or the other of the sexes. Our entire social system is built upon the fact that certain critical differences do exist and on the belief that many more are significant. Recently, however, there has been a tendency to minimize the secondary differences and to account for them as the result of social and psychological conditioning. Proponents of this view are inclined to endow men and women with equal abilities, qualities, and rights, and to insist that women, except for their reproductive function, do not differ in any essential degree from their men folk.

Mr. Scheinfeld has surveyed with exemplary catholicity the recent scientific literature on the nature and degree of sex differentiation. He brings together the scattered results of hundreds of workers and summarizes their findings in anatomy, growth, behavior, physiology, endocrinology, psychology, vital statistics, crime, sickness, clothing, skills, division of labor, achievement, and various other activities and categories. He finds an overwhelming mass of evidence to support the contention that men and women are fundamentally and basically different—a difference which colors and permeates every aspect of life. It is, he feels, the wiser course, biologically as well as socially, to recognize these distinctions and to use them to advantage rather than to deny them and create unnatural tensions and frustrations.

Throughout, Mr. Scheinfeld emphasizes the differences between men and women but also insists that these differences cannot be assessed against each other. Men are not better or worse than women; they are simply different and complementary.

Since Havelock Ellis treated this classic subject, we have had no compilation of the steadily growing information dealing with it. It is, therefore, a welcome opus that Mr. Scheinfeld has produced, not only because he offers us a more modern compilation than Ellis, but also because he casts a wider net. Indeed, Mr. Scheinfeld's omnivorous appetite for evidence of sex differentiation almost produces an indigestion. It certainly is responsible for a touch of banality which might have been avoided by a more rigorous selection. However, *Women and Men* should prove a fascinating book to almost any reader.

H. L. S.

AMPHIBIANS AND REPTILES OF THE CHICAGO AREA

by Clifford H. Pope

Chicago Natural History Museum, $1.75
12 plates, 50 text figures, 276 pages

TO many people the frog is "a reptile with edible legs" as defined by the noted cynic, Ambrose Bierce. To thousands of biologists frogs, as well as salamanders, are "laboratory animals," creatures that afford excellent material for studies of the endocrine glands or developmental mechanics. To countless others —the amateur naturalists—,amphibians and reptiles are animals to be sought and observed for pleasure, recreation, or sport.

This book is designed for those in all three categories. The uninformed gourmet will learn that a frog is not a reptile and that it and its toad and salamander relatives perform useful services to mankind through their consumption of countless insects. He may also infer that indirectly they contribute to his welfare, since the foundations of many medical discoveries were based upon amphibian material. The biologist and the field naturalist will find in this book summaries of the habits, behavior, and reproduction of each of 52 species, with notes on their requirements under captive conditions, as well as means of identifying specimens.

Ably written by Clifford H. Pope, the author of two outstanding popular books (*Snakes Alive and How They Live* and *Turtles of the United States and Canada*), this is the most elaborate treatment of the amphibians and reptiles of any limited area that has yet appeared. Five colored plates depict 16 species, and each of 10 salamanders, 11 frogs and toads, 18 snakes, 3 lizards, and 10 turtles are illustrated in the other plates or in 50 well-chosen text figures. "Technical terms and scientific jargon have been avoided," to quote from the introduction, "but numerous details are included because much of the fascination of animal behavior lies in its complexity."

While this book is designed for use in the "Chicago area" including portions of Wisconsin, Illinois, Indiana, and Michigan that border on the southern end of Lake Michigan, most of the species treated are widely distributed throughout northeastern United States. Consequently it will be of immense value to naturalists and scientists, as well as to laymen, throughout this region—and the chap who believes that a frog is a reptile with edible legs had better read it too.

C. M. BOGERT.

NATURE ENCYCLOPEDIA

Edited by G. Clyde Fisher; five volumes bound in De Luxe Green Keratol lettered in Gilt, pages are 5⅜ x 8 inches. Lives and habits of Birds, Mammals, Fish, Reptiles, Flowers and Trees; described by renowned Naturalists; 700 illustrations, 200 in Natural color. The Literary Mart, 8 East 33rd St., New York 16, offers this set for $7.50. remittance with order, returnable for full refund within five days.

THE GOLDEN ROOMS

by Vardis Fisher

The Vanguard Press, $2.50
324 pages

THIS is a companion volume to *Darkness and the Deep*, by the same author, reviewed in NATURAL HISTORY Magazine, May, 1943.

It attempts to show how man created his speech and culture. The text is the type of fiction which does violence to historic accuracy, and the psychological interpretations of the situations created seem overstated. The plot embraces the adventures of two contemporary family groups: (a) a primitive apelike troop, (b) a pioneer *Homo sapiens* family. Group (a) is pictured in grossly exaggerated traits of anatomy and behavior, filthy, detestable creatures, revolting in every detail. Apes and other wild animals, not confined in cages, keep their pelts free from filth, so why not these apelike men? On the other hand the second family group (b) is perhaps too favorably delineated. Each of the two groups is headed by two leaders, a male and a female, individuals of superior intelligence, the inventors of fire-making and clothing in group (a), of bows and arrows, the domestication of animals, and the planting of seeds in group (b).

The more exciting episodes begin when these two contrasting groups discover each other. The male leader of group (b) is shocked by the revolting traits of group (a), resents their intrusion, and leads a party of his fellows to exterminate them. This seems to be the beginning of race prejudice. Then the leader of the victors is stricken with remorse and haunted by the ghosts of the dead, until he becomes a fear-ridden neurotic. His women on the other hand are more realistically minded, accepting a surviving infant of group (a), even defending it against the murderous threats of their men. If the reader of this book disregards the faulty historical sequences suggested, he may find profit in the author's psychological speculations, but they, too, are so exaggerated as to approach the abnormal.

C. W.

WITHIN THE CIRCLE

- - - - - - - by Evelyn Stefansson

Charles Scribner's Sons, $2.50
117 illustrations, 160 pages

THE circle is the Arctic Circle and the author, Mrs. Vilhjalmur Stefansson. Her husband, Dr. Stefansson, who years ago took upon himself the task of convincing people that the Arctic was not all ice and snow, but a rich land with many possibilities for the white man, has found in his wife an enthusiastic advocate of his favorite theme, the friendly Arctic. That Doctor Stefansson was right in his prediction of the future of the Arctic goes as a red thread through the present book, which is the writer's second on an Arctic subject. Even those who hesitate to accept the Arctic as a land that flows with milk and honey must admit, after reading it, that she has got some very strong points.

The idea of the book is to give a cross-section of the Arctic. To that effect, Mrs. Stefansson has turned the spotlight on six communities, separated by hundreds of miles and in many respects very different but with one thing in common: they are all located north of the Arctic Circle. The six communities are Disko Island, in West Greenland, Grimsey, tiny island north of Iceland, Kiruna and Gällivare in Swedish Lapland, Igarka in Siberia, Point Hope, Alaska, and Aklavik, Canada. Of these, the chapters on the modern Swedish mining center, the work of the Soviet Union in the Arctic, Doctor Livingtone's farm at the mouth of the Mackenzie River, and the large number of excellent illustrations will probably make the deepest impression upon the general public.

A little grey color mixed in with the rosy would not have done any harm to this otherwise pretty picture of the Arctic.

HELGE LARSEN.

WOODCOCK

- - - - - - - by John Alden Knight

Alfred A. Knopf, $4.00
15 plates, 1 map, 171 pages

THIS is a book for the lover of upland game-bird shooting. It is written in an easy vein as from one sportsman to another and contains a great deal of sound information collected from a variety of sources, seasoned with the author's own observations, and sauced with anecdotes. It is hardly, as the publishers state, the "first complete and up-to-date book" on the species, but the author makes no such claim. It is, in any case, an interesting and readable summary of knowledge and opinion on the subject.

The woodcock is nocturnal, or crepuscular, and secretive, and there are many things about it that have not yet been discovered or proved, concerning which there is, of course, much difference of speculative opinion. Is the twittering sound that is given as the bird leaves the ground of vocal or instrumental origin? Do the males return each year to the same chosen singing ground? Are the sexes distinguishable without dissection? These and similar questions have been the subjects of much argument and discussion. The author does not always agree with the majority opinion, but he is frank to confess that there is disagreement. His summary of fact and opinion gives, therefore, a good picture of the bird's life and behavior.

All this is written with one eye on the woodcock as a game bird, and the last few chapters of the book are devoted wholly to that aspect of the topic. Favorable hunting grounds, equipment, dogs and guns, and hunting methods are discussed in detail from the writer's considerable personal experience. Those who are of similar persuasion will enjoy comparing notes with him, and they, as well as those who may be interested in the bird for its own sake, will profit by his general discussions.

The colored plates by Edgar Burke are pleasingly good, and the photographic illustrations interesting.

J. T. ZIMMER.

CURRENTS & EDDIES

- - - - - by William J. Schaldach

Trade Edition by A. S. Barnes and Co., $5
Limited Edition by Countryman Press, $12.50

IN this day of war-emaciated books, the format of *Currents & Eddies* is as restful and pleasant as its content. The book has a most attractive dust cover reproducing one of the author's color plates, is printed in large clear type, and contains fine reproductions of Mr. Schaldach's beautiful and original paintings and line drawings. It is written in an effortless way, conveying both the thrill and the relaxation of fly rod angling. Anyone, angler or not, interested in the habits of trout, black bass, or even bullheads, and the waters in which they live, will find pleasure in reading it. The angler, or the would-be angler, will get help about how to assemble his tackle and how to use it. Mr. Schaldach has vividly conjured up visions of wading and casting, of flashing trout and arched rods, and of that lovely moment when "the chill of evening creeps down and freshly caught trout are curling and sizzling in a pan over a birchwood fire."

In addition, *Currents & Eddies* has a very special appeal and value, for from its informally written pages emerges the picture of a very integral part of country boyhood in America—a boyhood "whose simple adventures are" as the author says "with variations, your own."

F. LAM.

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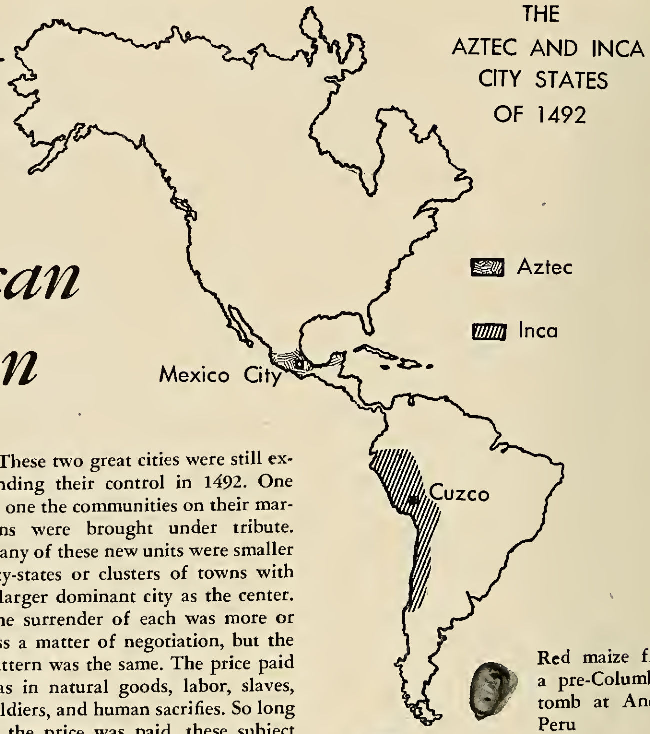
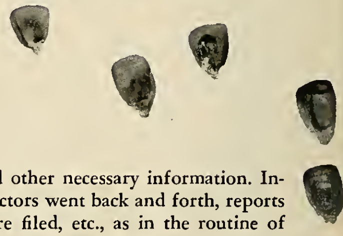


By CLARK WISSLER
Curator Emeritus, Department of Anthropology, American Museum of Natural History

THE Spanish explorers following closely on the heels of Columbus found two large political units in the Americas, the Aztec regime in Mexico and the Inca in Peru. The relative extents of these so-called empires are shown on the map. Many books have been written seeking to prove that these were not empires like those of the Spain, France, and England of 1492, which is true; Aztec- and Inca-land were different because they were not modern but reminiscent of Egypt, Ur, and Indus of early days. They were city-states and had evolved along lines generally parallel to the Old World city-states we mentioned in an earlier article on Wheat and Civilization.[1] The two outstanding seats of power were the Aztec City of Mexico and the Inca City of Cuzco. Between and surrounding these two dominant nations were smaller city-states.

➤ These two great cities were still extending their control in 1492. One by one the communities on their margins were brought under tribute. Many of these new units were smaller city-states or clusters of towns with a larger dominant city as the center. The surrender of each was more or less a matter of negotiation, but the pattern was the same. The price paid was in natural goods, labor, slaves, soldiers, and human sacrifies. So long as the price was paid, these subject cities were autonomous. The degree of control varied with circumstances and distances; and an unsuccessful rebellion was usually in progress somewhere. So the exact geographical limits of such city-states are usually subject to historical controversy. Yet approximate boundaries are possible. The Aztecs had on file maps showing roads, locations of subject towns, etc. Lists were kept of the tribute due and other necessary information. Inspectors went back and forth, reports were filed, etc., as in the routine of modern governments


Red maize from a pre-Columbian tomb at Ancon, Peru

The Old World city-state pattern of empire began with Ur and ended with Rome, after which the Dark Ages of the barbarians prevailed, to emerge eventually through feudalism into the Christian type of empire of which the Spain of 1492 was a good example. The Aztecs and Incas, on the other hand, were yet evolving a stone and bronze age type of city-state civilization such as we described in the previous article. This is why the favorite way to characterize these American aboriginals in 1492 is to say that they were engaged in an evolution of civilization, in a way parallel to what had happened in the Old World, but about 2000 years behind schedule.

We gained an insight into Old World civilization by noting that its distinctive characteristics were cereals and animal husbandry. Everywhere and even now among the heirs of these Old World civilizations wheat is the chief cereal. We shall find it equally important to recognize that the basis of aboriginal New World civilizations was the group of cereals designated as maize (corn), accompanied by a weakly developed animal husbandry. Herein lies the chief contrast. We can now see the significance of our previous statement that Old World civilization is based upon a well integrated, nicely balanced economy of cereals and animal husbandry.

The Pattern of New World Civilizations

We found it useful to characterize Old World civilizations by enumerating fundamental traits defining a pattern in their then new way of living. It may be doubly illuminating to tabulate in parallel columns the traits most

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[1] NATURAL HISTORY for November, 1943.

The story of one of our great basic foods—the mystery of its origin and how it came to dominate the ndustry and economy of prehistoric civilization in the New World

A ➤ In 1920 a quantity of ancient fodder was found in the ruins at Aztec, New Mexico, dated about 1120 A.D. by the tree ring method of chronology. During the lunch hour, one of the mules belonging to the workmen ate a large part of the fodder before discovered in the act. The ear marked **A** at right is one of the pieces from that cache

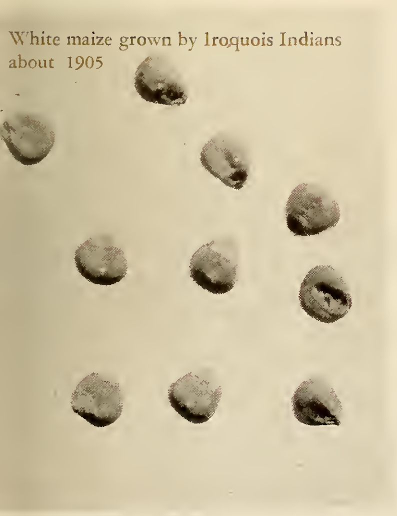
OTHER TYPES OF MAIZE IN THE EAR

B Pre-Columbian maize, fourteen rows of grains to the ear, in spiral. (From Arica, Chile)

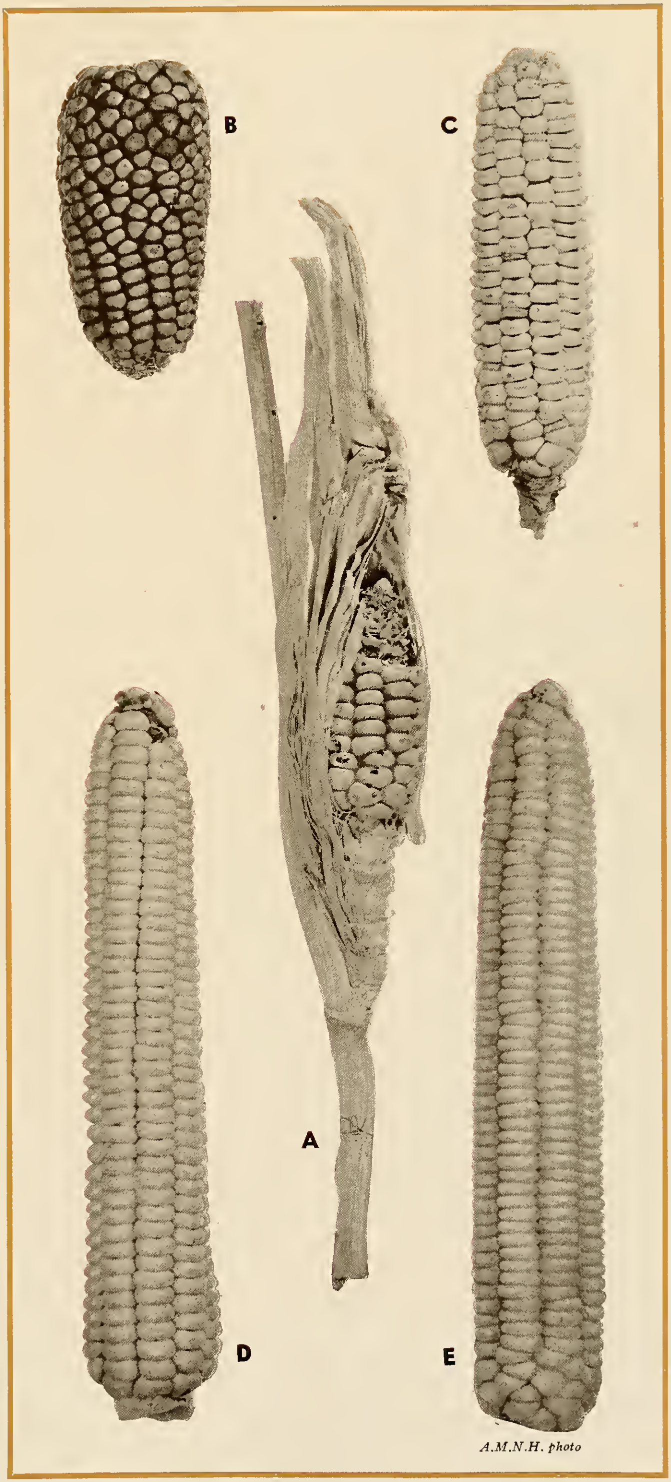
C Modern maize, eight rows. Pawnee Indians

D Modern maize, eight rows. Iroquois

E Modern maize, eight rows. Pueblo, New Mexico

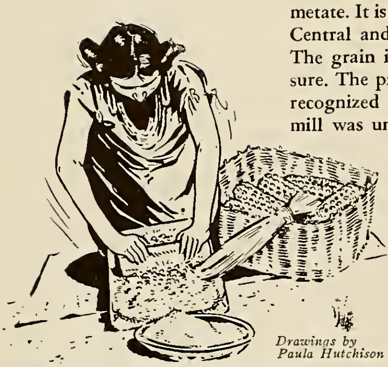


White maize grown by Iroquois Indians about 1905



A.M.N.H. photo

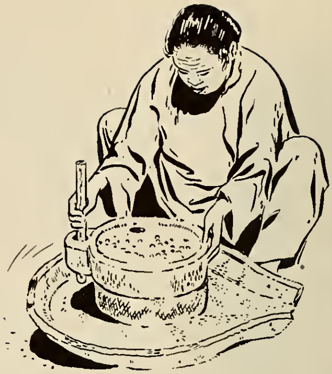
↖ PRE-COLUMBIAN and modern maize, or corn. As a rule the ears and grains of pre-Columbian maize are smaller than modern maize



Drawings by Paula Hutchison

◄ The New-World device for grinding grain: the metate. It is still in use in the United States, Mexico, Central and South America, and the West Indies. The grain is crushed between two stones by pressure. The principle of the revolving wheel was not recognized in the New World, hence the circular mill was unknown

► The Old-World way of grinding grain is the hand mill. It goes back to Ur, Egypt, and ancient times generally, and is still seen in Oriental and Mediterranean countries. The advantage of the revolving principle is that power can be applied. First, hand power was used, then draft animals, water, wind, steam, etc.



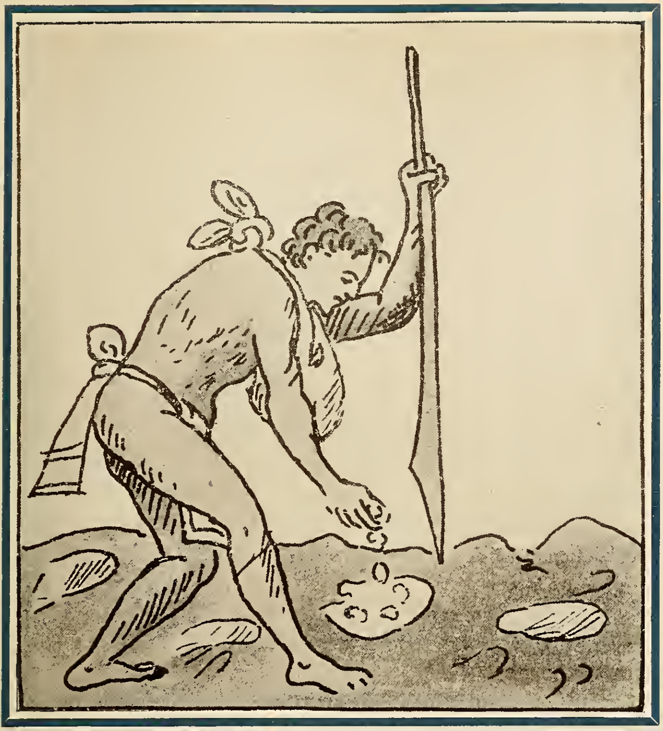
distinctive of the Old World civilizations as compared with those defining the character of New World civilizations, as in the accompanying table.

Close parallelism seems to dominate these two patterns, but certain differences are conspicuous. Thus in the New World there is neither the wheel nor its common applications in the cart, pottery wheel, and rotating hand mill. The metate, a flat slightly concave stone, is the New World device for crushing cereals for meal or flour. Secondly, neither cattle, horses, sheep, nor swine were known. Instead of the time-honored plow, the New World used the simple digging stick, with its more specialized form, the spade, or foot-plow. In other respects the two world patterns are remarkably similar. Yet what a gap these few exceptions leave in the profile of American aboriginal civilizations. To their Spanish conquerors the Aztec and Incas seemed contemptible—no cannon, no steel weapons, no metal armor, no horses, no oxen, no carts, man power only.

Another point of interest to us is that so far as is known the élite of the Aztec and Inca possessed some knowledge of the barbarian tribes on their respective frontiers but were wholly unconscious of an Old World and the achievements of its inhabitants. The possibility of such an entity as another hemisphere had not occurred to them. Small wonder is it that the appearance of Europeans with unheard-of weapons, ships, and horses, with a background of learning and insight incomparably more acute than they had ever experienced, rendered them incapable of any effective resistance.

Outstanding Traits in Old and New World Civilizations

Old World	New World
Cereals (wheat, barley, etc.)	Cereals (types of maize)
Domesticated animals (cattle, horses, asses, sheep, swine, dogs, poultry, bees, etc.)	Domestic animals (turkey, guinea pig, llama, dog, bees, etc.)
Plow (drawn by man, later by cattle)	Digging stick (foot plow and hoe)
Wheel (cart, hand mill, potter's wheel, etc.)	No wheel (human packing, metate, hand shaped pottery)
Cities, aqueducts, and irrigation systems	Cities, aqueducts, and irrigation systems
Temples and state religious systems	Temples and state religious systems
Metals (gold, silver, copper, and bronze)	Metals (gold, silver, copper, and bronze)
Special hand crafts (as in stone, wood, textiles, etc.)	Special hand crafts (as in stone, wood, textiles, etc.)
Writing (wax and clay tablets, paper, inscriptions on stone)	Writing (paper, the quipu, inscriptions on stone)
Slavery and regimentation of labor	Slavery and regimentation of labor
Tribute, or taxes, imposed upon subjected cities	Tribute, or taxes, imposed upon subjected cities
State ownership of resources and land	State ownership of resources and land
State highway systems	State highway systems
Freight by ox cart, rapid transit by horses	Freight by human carriers and llamas, relay human runners, suspension bridges



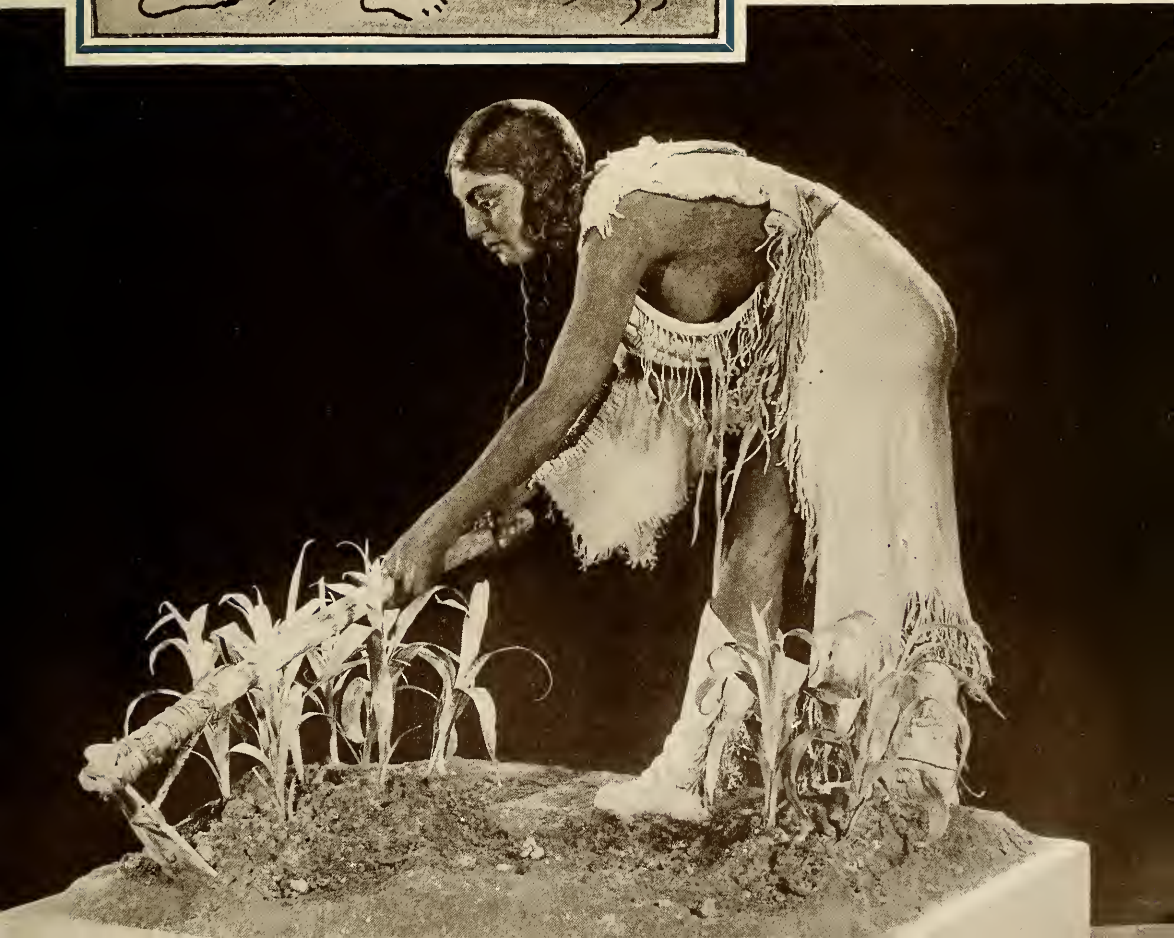
◀ NATIVES of the Western Hemisphere did not know about the plow when Europeans arrived. Digging sticks and spadelike implements were the universal New World agricultural implements. This illustration is an Aztec drawing showing a farmer planting maize with a digging stick. The traction plow is an Old World device, assumed to have evolved from the digging stick

From the Codex Florentino

▼ A MANDAN INDIAN GIRL of about 1700 A.D. cultivating maize with a hoe, made of the shoulder blade of a bison.

The history of the hoe is obscure. In the New World it had a limited distribution in eastern United States but was unknown in our southwest, Mexico, and South America

Statuette by Paul Wright, in the American Museum



Some of the Wild Hunters Begin to Grow Plants

In a former article[2] we noted that the first human beings to discover America were primitive stone-age hunters from Siberia. The time was late Pleistocene, when the last of the huge elephants were still tramping through the swampy parts of North America; camels, wild horses, and tall long-legged bison could yet be seen in the open grass lands, and the giant sloth was using caves as burrows suitable to his size. Other kinds of game more modern in character were there in plenty. Up until that moment none of these American animals had ever seen human beings, so they were ignorant of man's predatory nature.

Once in America, these invaders found themselves in a hunter's paradise, free from enemies of their own kind and surrounded by game easy to approach. The animals were similar to those of their homeland, but the plants were for the most part strange, inviting experimentation to learn their uses and dangers. All of these new objects and freedoms stimulated the savage mind; food was abundant, so the population increased rapidly. When a band of hunters became too large it divided, and the new band moved into the unoccupied country ahead. Old vocabularies were discarded and new words invented to designate new objects and relations. The tempo of life and health was stepped up. At least, this seems a reasonable expectation.

No wonder anthropologists found about 1500 different languages spoken in the New World, and though linguistic experts have been able to group these languages into about 175 families of speech, they have been unable to be sure of genetic relations between any of these families. Again, those who study the ways of living, customs, and habits of the many hundred surviving tribes of Indians, find them of great variety. The new methods devised by archaeologists are revealing that rapid changes occurred in ways of living even in the same localities, far too rapid to be correlated with changes in climate and other ecological phenomena. In the main, this welter of detail will be found consistent with the expected adjustment of successive generations of hunters to the changing local environments besetting their migration routes.

As the hunters spread southward, every now and then a favorite plant food would not be found in the next strange locality. Thus new problems would arise, such as: could plants be moved? When the Andes were reached, large game was probably less plentiful than formerly, but plants did not decrease, merely changed in kind. From a survey of the plants domesticated many botanists favor the Andean highlands as the place where good wild plant foods were most abundant and where newcomers would therefore find the greatest incentive to experiment in agriculture.

That maize was the first plant to be cultivated is unlikely but its wide distribution testifies that, once it was on the way, its merit was obvious. Certain caves in Kentucky and Arkansas have yielded evidence that agriculture was practiced long before the earliest appearance of maize in their deposits —for example, seeds of the domesticated sun-flower, the giant ragweed, etc. Nor is it likely that any single plant can be proved to have been the first. Conditions being favorable in many localities, there may well have been spontaneous independent experiments with different local species of plants in different sections.

List of Native American Plants of Economic Importance

CULTIVATED

Maize
tobacco
manioc
pumpkin
cotton
avocado
beans
calobosh
chili
ragweed
barnyard grass
maté
potato
peanut
sweet potato
tomato
sisol
pineapple
chocolate
coca
sunflower
pigweed
cashew nut
cinchona

NOT CULTIVATED

rubber
copol
Indian hemp
nettle
basswood
wild rice
pawpaw
plum
water lily
camass
mesquite
acorn

That the Indian eventually selected food plants of extraordinary qualities is evidenced by the world-wide use of maize, the potato, bean, peanut, squash, cassava, pineapple, etc. The Old World can scarcely rival this list. So quickly were many of these carried to all parts of the world that it has been difficult to prove their New World origin, except by noting that their obvious wild ancestors were not found outside of the New World. Thus in Europe maize was first called "Turkish corn or wheat," for the same reason that the native poultry of the Aztecs is called *turkey*, even in America, because these foods were quickly adopted by the Turks and from thence introduced into Europe. In the same way, the name "Irish" potato concealed for a long time the South American origin of that important food.

Weak Development of Animal Husbandry

That the farmers of the New World made the most of plant exploitation is clear. The intruding white population did not discover a single wild plant of outstanding economic importance not recognized and used by the aborigines. Even rubber was gathered in the Amazon country and produced in Mexico from the dwarf guayule plant.

The aboriginals were aware that animals could be tamed, but they failed to grasp the idea that the propagation of animals for their flesh was feasible. And in animals for traction the aboriginal score stands at zero. Was this due to blindness as to the virtues of the wheel or because suitable traction animals were lacking? When we note that in ancient Mexico toy animal figures were made mobile by small wheels, the mystery deepens. The more primitive tribes in the bison area of the United States and the Eskimo of the Arctic used dogs for traction, the former with the travois and the latter with sleds in winter. The Aztecs had no burden-bearing animal; the Inca used the llama, which could carry a load of about 90 pounds. That tells the story. It is a poor showing in contrast to the ancient Old World with oxen, asses, horses, camels, elephants, etc., able to draw heavy loads and carry one or more persons upon their backs. The Aztecs were doomed to carry freight upon their own backs: the roads to Mexico City were lined with carriers, many with huge packs upon their backs for delivery to the Aztec tribute gatherers. Now and then came a trader with a troop of carriers, but most frequently men and women carried goods individually to market in the towns. Within the City of Mexico were numerous canals and

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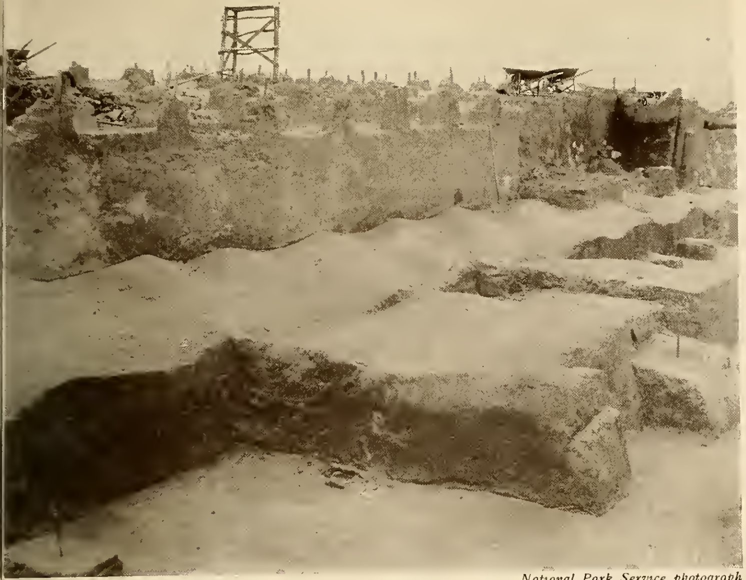
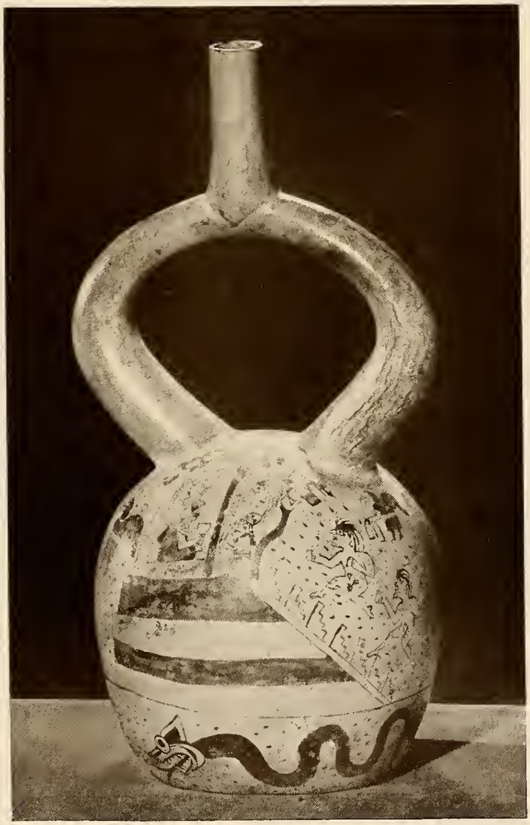
[2] "The Origin of the American Indian," NATURAL HISTORY, September, 1944.



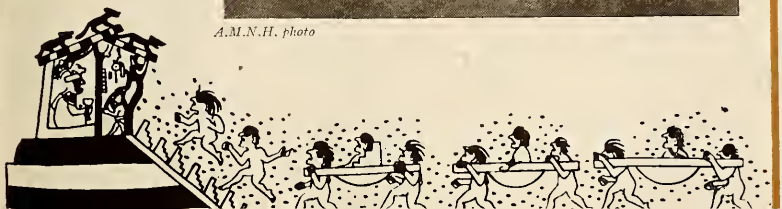
National Park Service photograph

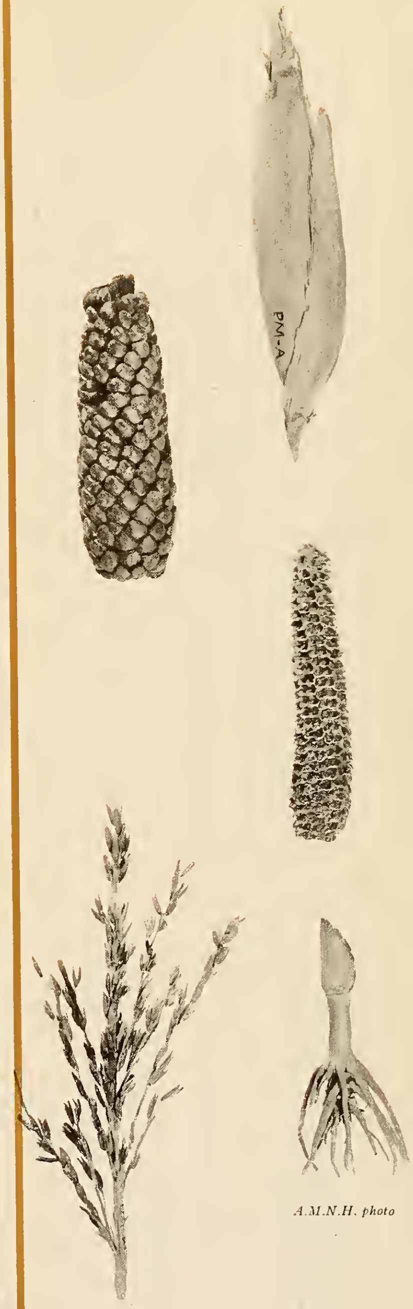
AN ANCIENT CORNFIELD UNCOVERED. Skillful excavating permitted archaeologists to expose the wavy surface several feet nderground representing the orderly ridges of arth. This field was tilled by prehistoric Indians on what is now the Ocmulgee National Monument, Macon, Georgia. The early people later buried he field while landscaping for a ceremonial building



A.M.N.H. photo

▸ **RAPID TRANSIT BY MANPOWER** in old Peru: a jar and the drawing that decorates it (*below*). The drawing shows a dignitary surprised by unexpected guests, perhaps officials with captives from "the front." The dogs on the roof are behaving normally





A.M.N.H. photo

▲ **EARLY PRE-COLUMBIAN MAIZE** excavated by Junius Bird near Arica, Chile, showing tassel, root-node, ear, husk, and cob. Corn was cultivated many centuries ago and over a wide area in North, Central, and South America. But it was probably not the first agricultural product in the Western Hemisphere then the lake, crowded with canoes similarly loaded, but over the country at large, freighting between cities and towns was back-breaking drudgery. Some of the rich were carried in litters, but most people walked, burdened with baggage.

We have praised maize as a cereal fit to implement a civilization, yet as a food, wheat makes a strong claim for being the No. 1 world's cereal. Above all it is still the leading source of bread. Maize was a good substitute, but its modern popularity rests upon its value as a stock-food. The weak point in Old World animal husbandry was the want of a satisfactory stock-food, but the world was quick to discover the superiority of maize for animals. So let us give the aboriginal American his due. He may have a poor record in the integration of agriculture and stock raising, but he compensated for it by contributing to the world the ideal stock-food, thereby bringing about an almost ideal integration of agriculture and animal husbandry, the one basic principle in maintaining modern civilization.

Origin of Maize

The wild ancestor of wheat was not discovered until about 1900; and as for maize, no wild plant has even yet been found which qualifies unquestionably as the original ancestor. The leading contestants for the honor are:

Teosinte (*Euchlaena mexicana* Schrad.)
Tripsacum (*T. dactyloides* L.)
Pod Corn (*Zea mays tunicata*)

Neither cultivated maize (*Zea mays* L.) nor Pod Corn has been observed able to propagate itself in a wild state. Neither do the traditions of Indian tribes nor early colonial documents give much help in recovering the lost history of maize. The first explorers found it grown from Maine and Quebec on the north, to Florida on the south, in the Mississippi valley, in the West Indies, in the lowlands of South America, in the Andes, and as far south as Patagonia. Archaeology has proved its antiquity in our Southwest, Mexico, and the Andean countries (*see map p. 65*).

Perhaps no other domestic plant has been subjected to as much exhaustive botanical research as maize. Many experimental agricultural stations have made such research a major part of their respective programs, a large fraction of which have been concerned with a search for wild ancestors, because of the need for a clear understanding of maize genetics. Yet the mystery remains. However, the intricate detailed knowledge of maize chromosome patterns does make some suggestions. The tendency now is to assume a South American Andean highland origin for its first cultivation, and so prevails the still unrealized hope for finding a wild ancestor somewhere in that area.

Maize is regarded as a grass, prone to cross with a wide range of other grasses. Further, domestic maize still reveals flexibility to environment, rendering its specific adaptation to local conditions easy.

On the other hand, the original Indian type of maize possesses a vitality equal to the preservation of its essential qualities, even though cultivated for centuries by the more primitive hunting tribes of the marginal maize areas. The surviving modern types were produced from seed originally taken directly from Indians in eastern United States. The several recognizable modern varieties are:

Pointed popcorns
Dent corns
Flint corns
Flour corns
Sweet corns

The latest theories about the origin of maize are chiefly of two types:

(a) that it originated in Guatemala in the cultivation of a wild grass, teosinte or tripsacum;

(b) that the Andes was its home and that the ancestor was a form of wild pod corn not yet identified.

The modern approach to the solution of the problem is through the study of chromosome patterns in the germ cells. The most recent work by P. C. Mangelsdorf and his students suggests that the earliest form of maize was propagated in South America as a hybrid, which spread throughout the Andes, finally reaching Central America; there it was again crossed with a related wild plant, finally reaching into the valley of Mexico, where once again it crossed with a wild grass. Thence, some of this seed passed into the West Indies and southern United States, to be returned to the Andean highlands, all in pre-Columbian time. The arguments used in debating these theories are too technical to be understood by anybody except a few experts in the genetics of modern maize.

The Geographical Setting

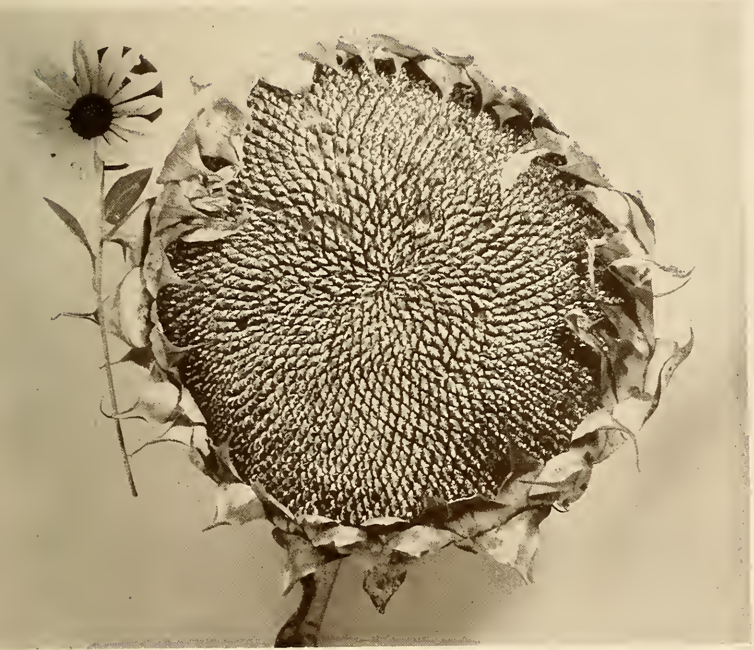
We noted that civilization in the New World began in the central part

A.M.N.H. photo

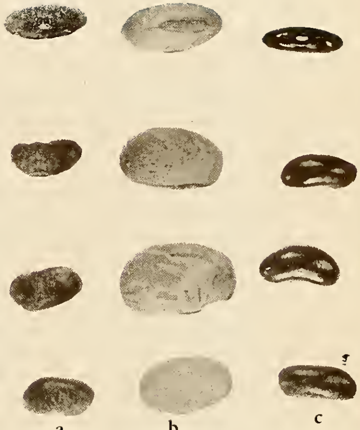
▲ ACCORDING TO ONE THEORY, MANIOC was the first plant to be domesticated in the New World. That it is a good food for man and beast is clear from its popularity and wide modern use under the names cassava, sago, and tapioca. It is easily cultivated and well suited to people on the level of a hunting economy. Originally grown in eastern South America and the West Indies, it has been introduced to the natives of tropical Africa and other parts of the Old World. Civilized peoples grow it for stock-food where the climate is suitable. The root is pulverized and dried, providing a good cereal substitute

A.M.N.H. photo

THE MODERN cultivated sunflower and the wild sunflower compared: an illustration of the improvement that can be accomplished in a plant by primitive farmers. Cultivated seed heads as large as any now grown have been found in pre-Columbian rock shelters in Arkansas and Missouri. The Indians of eastern United States were observed growing sunflowers by the first colonists. They ate the seeds parched and ground into flour and extracted an oil from them



Photograph courtesy of C. M. Goethe, in Sierran Cabin . . .from Skyscraper



A.M.N.H. photo

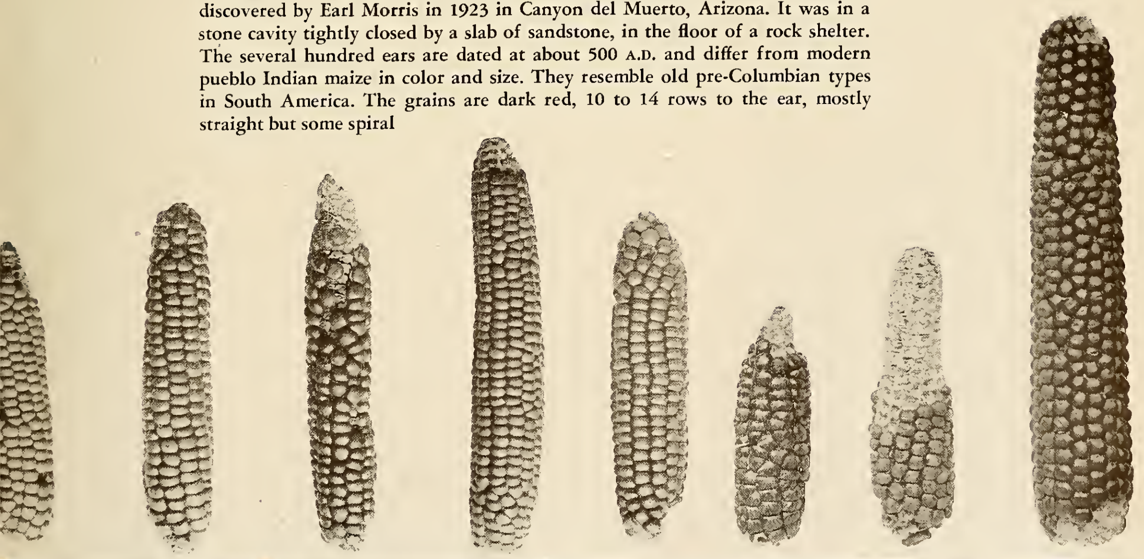
THE CULTIVATED BEAN is of New World origin. Two types grown in pre-Columbian times are compared here with a modern type

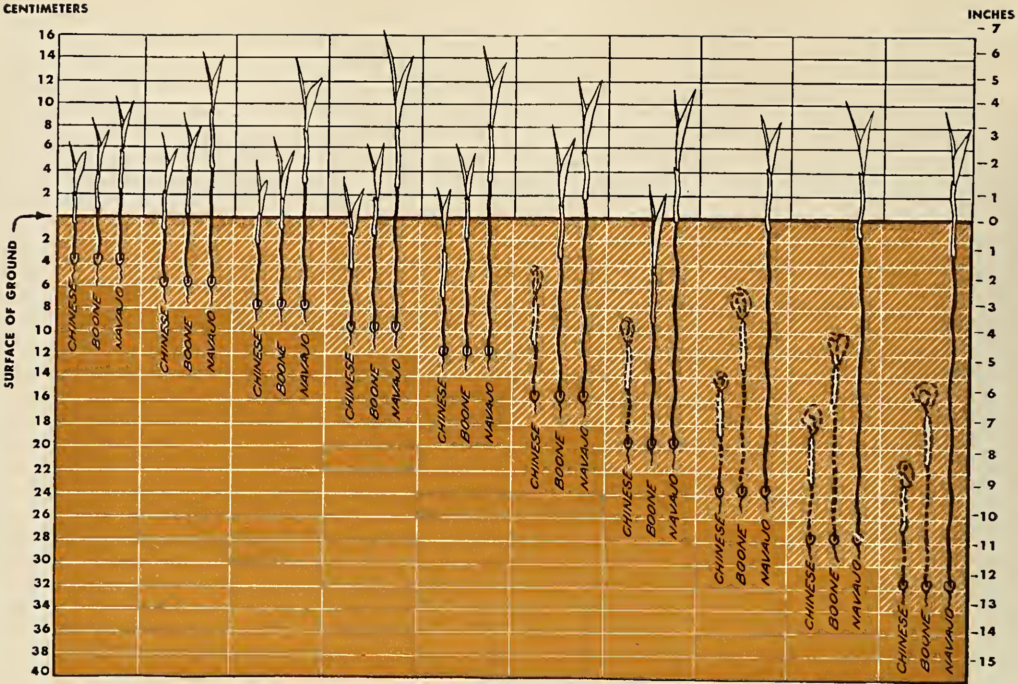
(a) Kidney beans from Surco, Peru

(b) Lima beans from Surco, Peru

(c) Kidney beans, Iroquois, about 1905

▼ RANGE IN SIZE at one time and place is shown by these ears from the largest and best preserved cache of pre-Columbian maize ever found. The collection was discovered by Earl Morris in 1923 in Canyon del Muerto, Arizona. It was in a stone cavity tightly closed by a slab of sandstone, in the floor of a rock shelter. The several hundred ears are dated at about 500 A.D. and differ from modern pueblo Indian maize in color and size. They resemble old pre-Columbian types in South America. The grains are dark red, 10 to 14 rows to the ear, mostly straight but some spiral



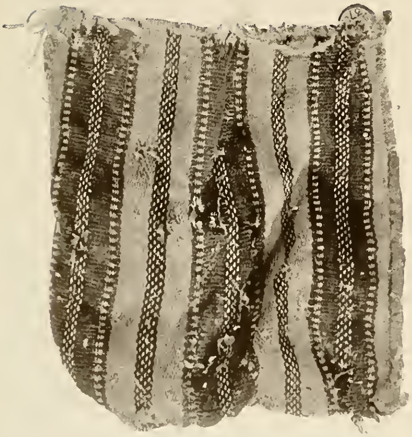


After G. N. Collins, courtesy The Journal of Heredity

SUPERIORITY OF NAVAHO MAIZE FOR DEEP PLANTING

▲ PROOF that Navaho corn is adapted to planting at a depth of more than one foot (32 cm.). The type was developed by artificial selection for planting deep enough in dry sand for the roots to reach the yet deeper moist ground

THE OLDEST KNOWN POPCORN. The well-popped grains were still fluffy white when found in the adjacent bag attached to the belt of a mummy in Chile. The popcorn was probably left as a mortuary offering. The horny shells remaining show that the kernels were deep red



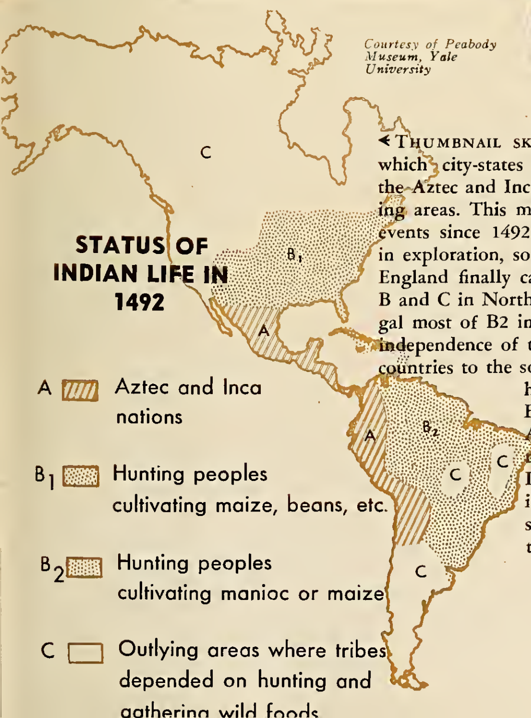
A.M.N.H. photos

A.M.N.H. photo

▲ REPRESENTATIONS of corn on Peruvian pottery of the early Chimu Period, about 500 A.D.

➤ POD CORN, one of the three contestants for the honor of being the ancestor of maize, here shown in a pre-Columbian ceramic replica from Peru. Each grain has a separate husk as is usual among grains. But pod corn has never been observed to propagate itself in a wild state

Courtesy of Peabody Museum, Yale University


STATUS OF INDIAN LIFE IN 1492
A ▨ Aztec and Inca nations
B1 ▩ Hunting peoples cultivating maize, beans, etc.
B2 ▩ Hunting peoples cultivating manioc or maize
C ☐ Outlying areas where tribes depended on hunting and gathering wild foods
A
B1
B2
C
C
C
C
A

◀ THUMBNAIL SKETCH of the area in which city-states prevailed, including the Aztec and Inca nations, with outlying areas. This map is also the key to events since 1492. Spain had the lead in exploration, so seized all of area A. England finally came to control all of B and C in North America, and Portugal most of B2 in South America. The independence of the United States and countries to the south explains why we have two Americas—English-speaking America (Canada and the United States) and Latin America (Spanish- and Portuguese-speaking countries to the south)

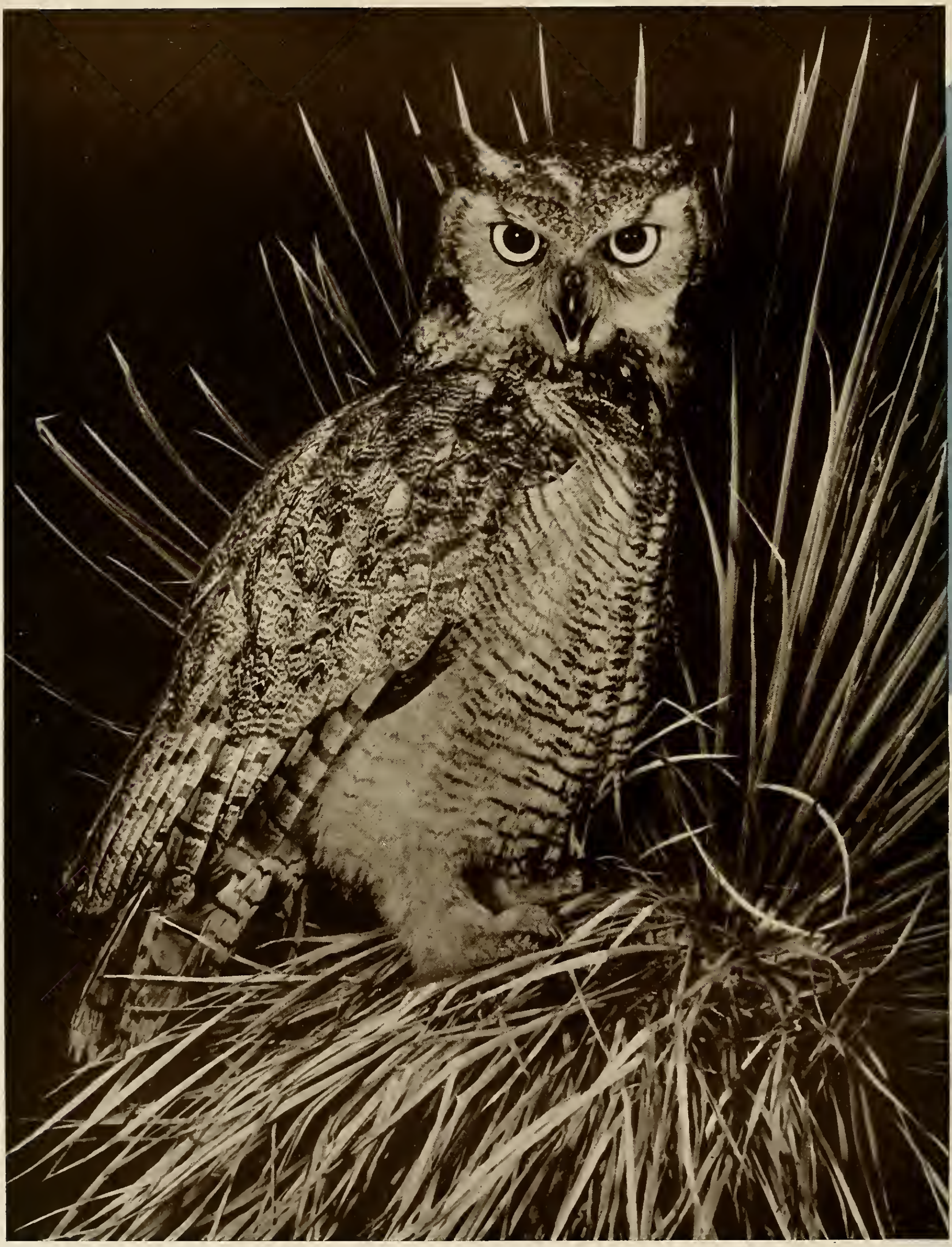
of the land mass (*see map*). Mexico, Central America, and the Andes highlands are neighboring regions. However, if we look at separate single complexes of living habits, some of them will show a wider geographical distribution than others. For example, the cultivation of maize in 1492 will show a wider distribution than many other traits of the Aztecs and the Incas.

Further the simple map we present tells the story of the evolution of society in the New World as of 1492. The two great city-states, Mexico City and Cuzco, ruled over the greater part of area *A*, comprising in all many smaller cities and towns more or less subjected. The boundaries between Inca and Aztec lands did not overlap but were widely separated in Colombia and Central America by intervening towns and cities. Area *A* on the map defines the region of intensive culture and the sphere of influence of the Incas and the Aztecs in 1492.

Thus this crude little map not only tells what happened here before 1492 but is the key to what happened since. It seems to make the fundamentals of American history so plain that one pauses in astonishment that the teaching of history even in our elementary schools should not have adopted this device from the first. Our grandfathers were fond of the expression "a thumbnail sketch;" this is an illustration of what they had in mind. If the reader has been able to grasp the significance of this map, he need not be a specialist in American history to "know where he is at."

What Might Have Been

Almost everyone who reads a short account of the evolution of these New World civilizations, spontaneously frames the same question: If Columbus had failed and America had remained isolated for another 2,000 years, what would have happened? Attempts have been made to answer this question. It is inconceivable that no advances would have occurred. On the other hand, the discovery of America was inevitable, because Europe had awakened, ships were at hand capable of long voyages, the idea of the rotundity of the earth was not only accepted by many learned contemporaries of Columbus but the proofs of the theory were considered sound. At most two more centuries would have brought the solution to what lay beyond the western sea. So such speculation is futile.

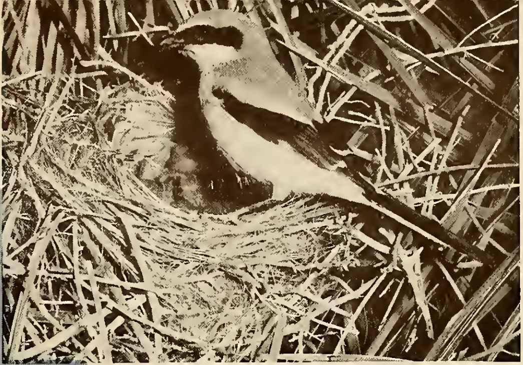


▲ Western Great Horned Owl: a bird of mixed reputation. It is equally efficient, at times, in the destruction of injurious rodents as it is in its attacks on game birds and poultry, for which it is widely condemned

➤ Texas Nighthawk. This little bird of the dusk is the most northern member of a tropical species that ranges widely through Central and South America. It has many points of difference from the common nighthawks of North America, of which there are a number of geographical forms. Among the more obvious differences are the smaller size and browner color, and the position of the white band near the tip of the wing

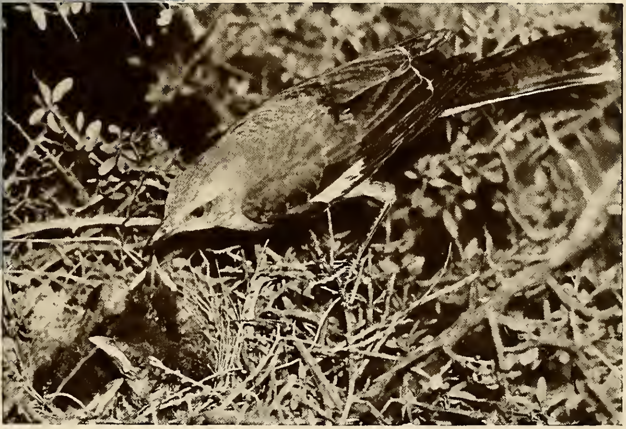
BIRDS
of the
DESERT

By GEORGE McCLELLAN BRADT



▲ White-rumped Shrike. Like other shrikes, this southwestern bird has the habit of impaling some of its prey on convenient thorns, from which it derives one of its common names—the butcher bird

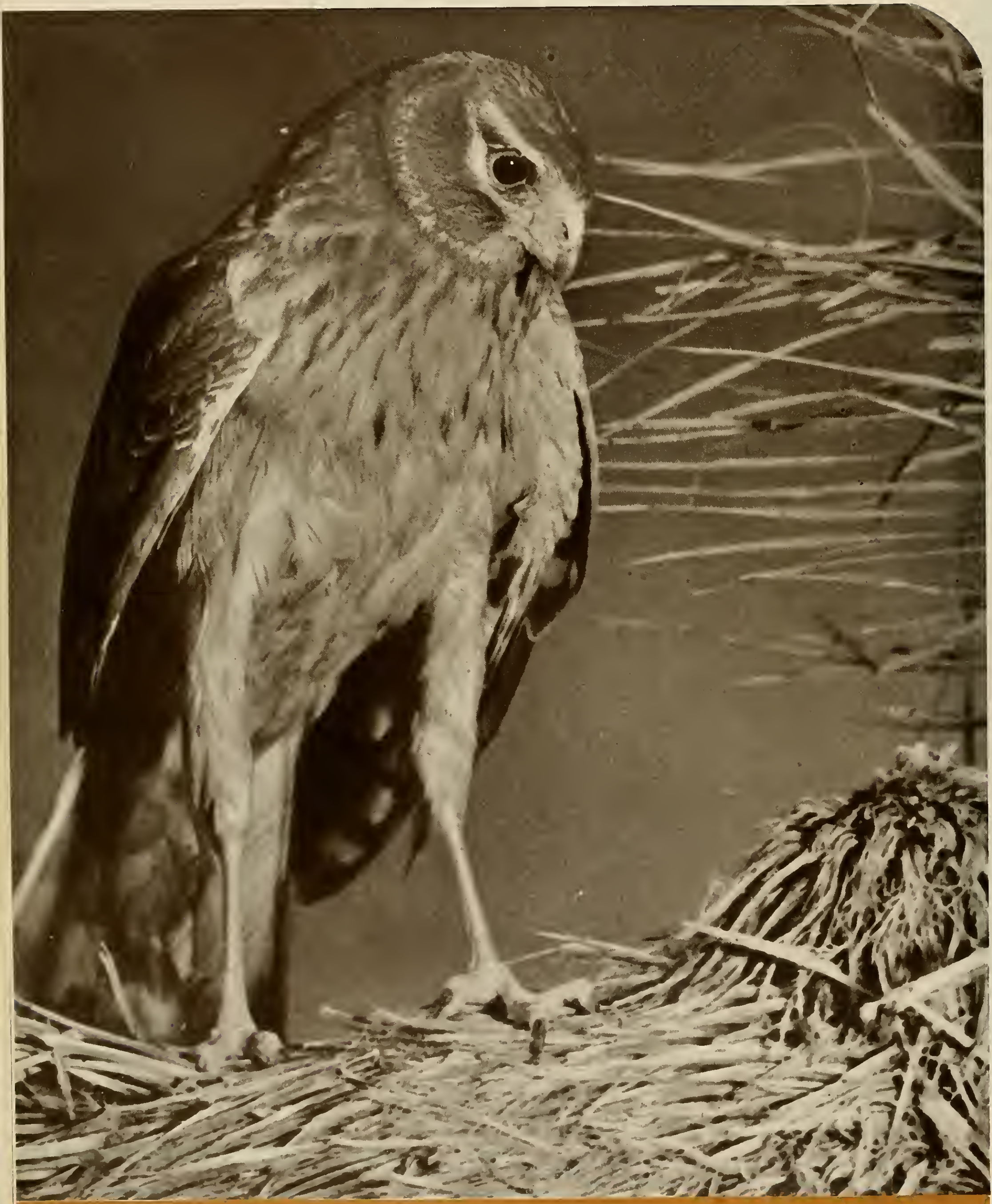
▼ Western Mockingbird: a talented mimic but also a gifted songster in its own right. Like the Eastern Mockingbird, it is much given to singing on moonlight nights, when it is not always appreciated by the drowsy listener. The bird's sober plumage belies its colorful voice

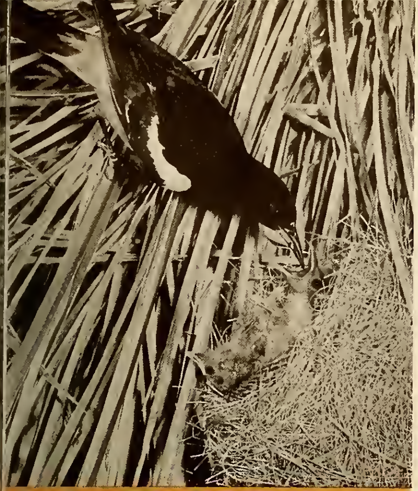


As typical of the Southwest as its deserts, canyons, mesas, and wooded mountaintops is its birdlife. Epitomizing the essential character of the region, that of contrast, Southwestern birds range in size from tiny three-inch hummingbirds to eagles with a seven-foot wingspread. In habitat they show wide variation from river-bottom herons to mountain-loving falcons, in nesting dates from incubating owls in March to nestling doves in September. In feeding habits they range from seed-eating finches to carnivorous birds of prey.

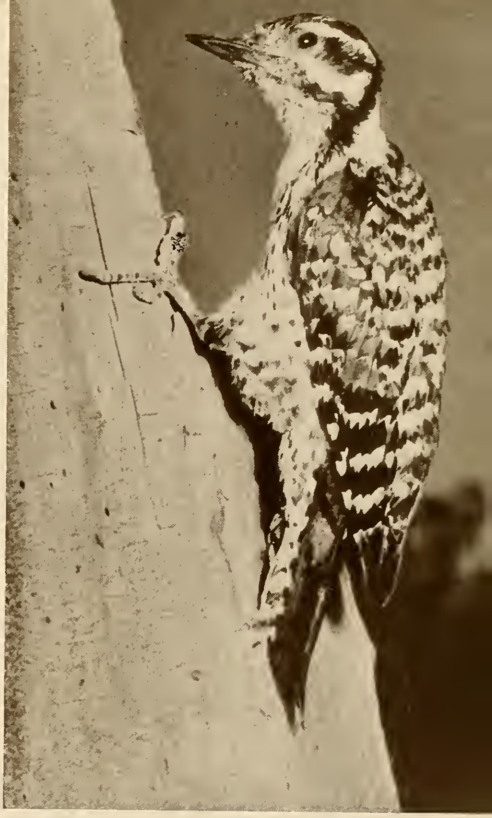
Twelve birds common to the numerous yucca and cactus deserts of southeastern Arizona, southwestern New Mexico, and western Texas are shown in the accompanying photographs, all of which were taken in the vicinity of El Paso. These conspicuous members of the region's bird population can all be found at one time or another along the Southwest's desert highways. Hawks perch on telephone poles or, like the eagle and vulture, soar high in the clear blue sky; shrike, thrasher, mocker, wren, and oriole fly to roadside yuccas; woodpeckers cling to weathered fence posts; and headlights pick out the night-loving owl. It is not in the least unlikely that each of these species could be seen by a watchful motorist on a single hundred-mile trip taken late in a desert spring.

▼ Marsh Hawk: a bird of wide distribution, nesting from northern Alaska and Hudson Bay to Virginia and Lower California and migrating to the West Indies and northern South America. Close relatives are found in Europe and Asia. The Marsh Hawks are highly beneficial, feeding largely on field mice, rabbits, and ground squirrels





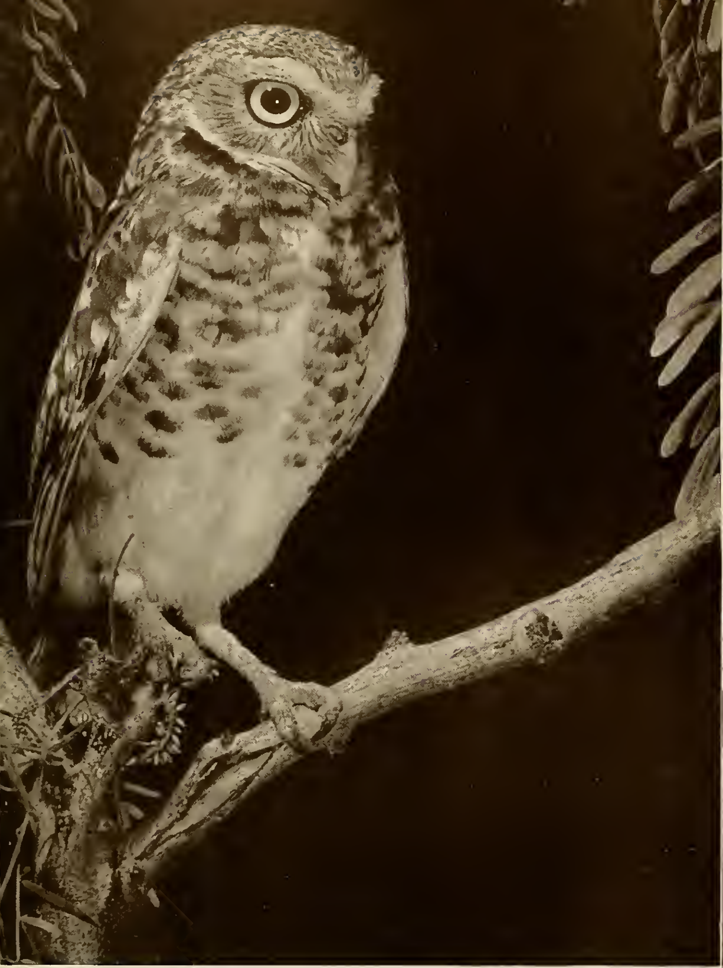
◂ **Scott's Oriole**: one of the duller members of a brilliantly hued group of birds but still handsomely dressed in olive yellow, black, and white. The female is somewhat more soberly clad in still duller yellow and green, with a little brown and white



▸ **Cactus Woodpecker**: a common woodpecker of the southwestern country, found in the valleys and lower elevations of the mountains. It is related to the downy and hairy woodpeckers but differs from them in various ways, such as by its speckled breast and sides and its barred back, without a broad white longitudinal stripe

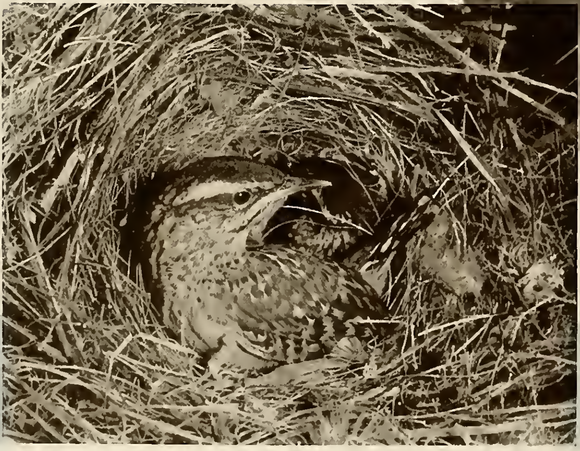
◂ **Curve-billed Thrasher**: an inhabitant of the thorny brush, building its nest of spiny twigs with a thin lining of grasses, in the shelter of such protecting plants as cactus and yucca

▾ The photographer observing from his blind

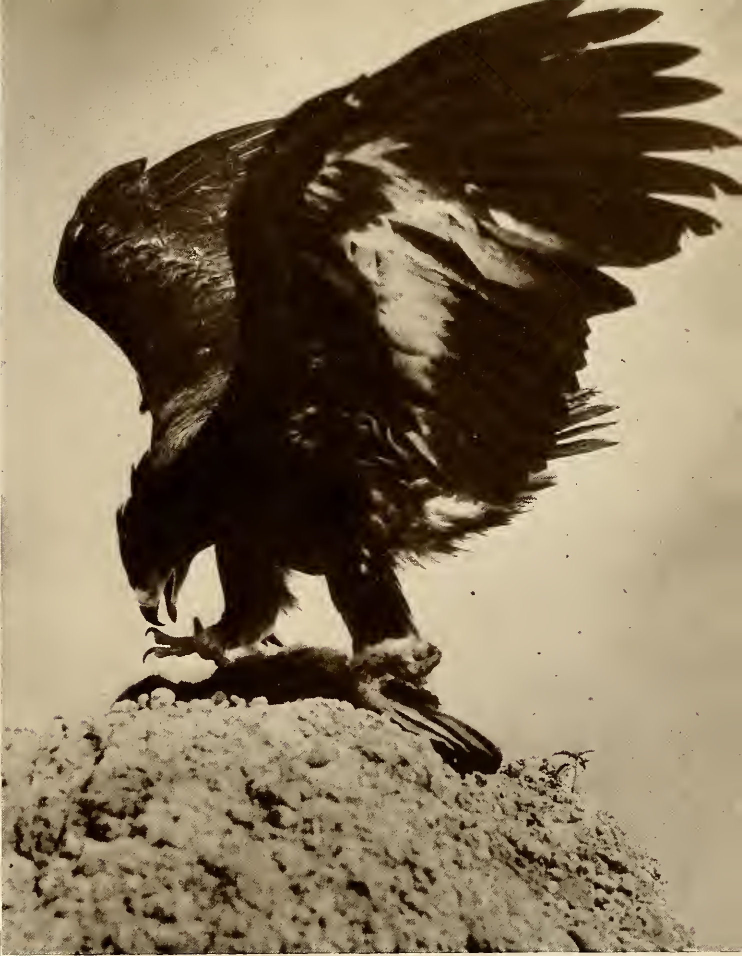


◄ Western Burrowing Owl: an interesting inhabitant of the open country, nesting in deserted prairie dog or ground squirrel burrows and coming out principally at dusk to hunt its prey. In the daytime these owls may often be seen standing at the entrances to their burrows, bobbing their heads or bowing comically and giving a chuckling call before backing down the holes or taking short flights to an adjacent position

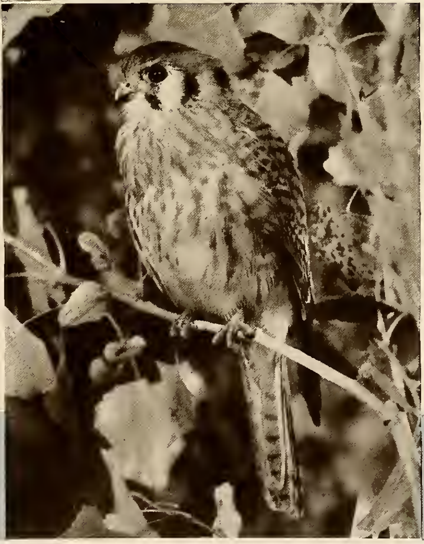
➤ Ash-throated Flycatcher. Like other members of its genus, but unlike most other members of the family, this species nests in holes in trees, posts, stumps, and similar places, using snake skins sometimes for part of the lining as does its relative, the Crested Flycatcher



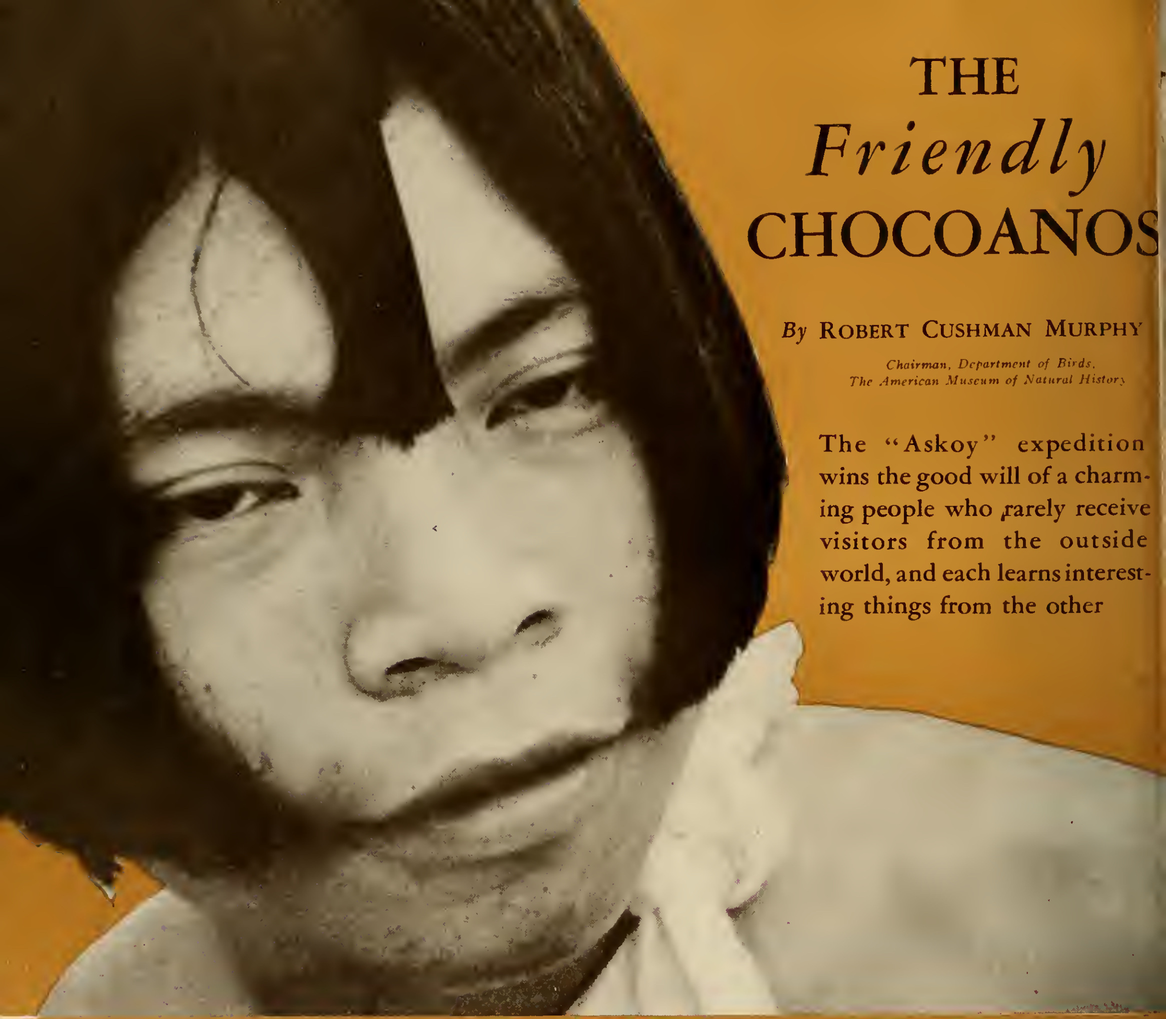
➤ Cactus Wren. The conspicuous nests of the Cactus Wrens are large, bottle-shaped structures, with the opening in the side through the narrow "neck." The bird's name tells of its favorite haunts. It is far less musical than most of its near relatives



➤ **Golden Eagle.** The Golden Eagle is not a true desert bird, but will descend from its mountain home when necessary in the search for food. Tales of this species carrying away children are purely imaginary



◄ **Desert Sparrow Hawk.** This little falcon, the smallest member of its family in North America, is a familiar bird of open or semiopen country, where it may be seen darting about in search of grasshoppers, mice, and such small prey. There are numerous geographical forms of the species, ranging from Canada to Tierra del Fuego



THE *Friendly* CHOCOANOS

By ROBERT CUSHMAN MURPHY

Chairman, Department of Birds, The American Museum of Natural History

The "Askoy" expedition wins the good will of a charming people who rarely receive visitors from the outside world, and each learns interesting things from the other

THE Chocó was inhabited land before Europeans discovered it, and Negroes inherited it. The Indians along the coast to the south of the Isthmus of Panama were, indeed, one of the earliest impediments to the advance of the conquistadors toward Peru. At first these hostile peoples were mostly by-passed rather than overcome by the Spaniards. Later, they were supposedly subdued, but in 1726 they succeeded, by means of a general uprising, in throwing off the yoke of their overlords. From that date to this they have remained a free folk, unaffected by successive political changes in the Spanish viceroyalties that have become American republics.

Although the Chocó Indians have thus escaped a large share of overt warfare, they have not been able to avoid more subtle competition that falls within the meaning of the term "struggle for existence." The transplanted African has proved a better "native" than the Indian himself. By this I mean merely that the Negro is more resistant to tropical heat, moisture, and diseases, and that he not only produces more offspring but also rears a larger proportion of them, even under the handicap of a sanitary system inferior to the Indian's. For such reasons black men in the Chocó appear to be crowding out the red. The process has already pushed most of the Indian communities inland and "upstream" into relatively inaccessible areas.[1]

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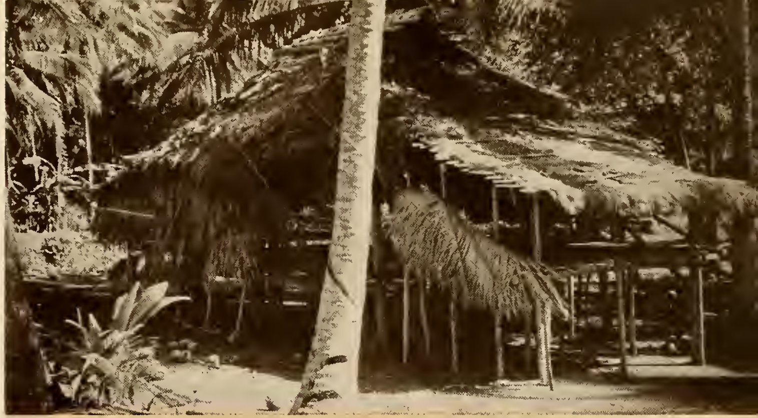
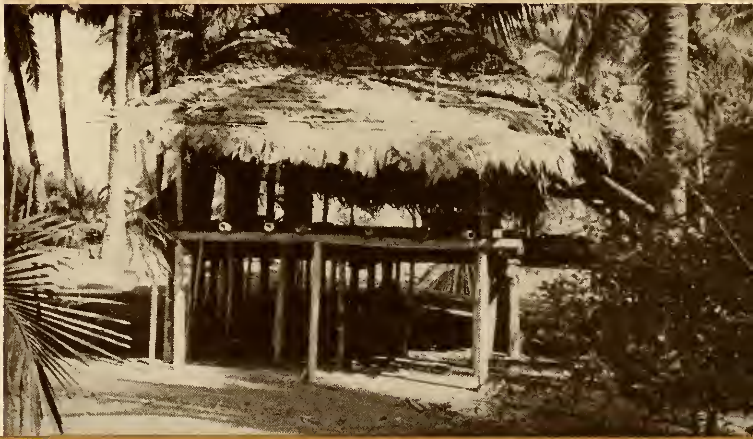
[1] These subjects have been expanded by the author in the following two publications: "Racial Succession in the Colombian Chocó," *Geographical Review*, vol. 29:461-471, 1939; "The Earliest Spanish Advances Southward from Panama Along the West Coast of South America," *Hispanic American Historical Review*, vol. 21:3-28, 1941.



(Above and below) **Chocó Indian houses** among the coco-palms on the barrier beach at Cocalito. These dwellings were not occupied at the date of the visit and had consequently fallen into slight disrepair. They were still filled, however, with many of the household utensils that the Indians use



An Indian youth who was traveling with his cle along the shore of the Ensenada de Coredó the time of the arrival of the "Askoy" Expedion. The chin and throat of this boy were ainted bright red below the line of the mouth

▼ **A glimpse** of the charming Chocó settlement near the mouth of the River Cocalito, as seen from the crest of the barrier beach that protects the site from never-ceasing surf

The first Chocó we met was a man making a call in the village of Santa Dorotea at Piñas Bay. When I saluted him, he walked forward and greeted us like a gentleman, smiling but showing no levity. He was wearing a khaki hat of the "Sherlock Holmes" type, with a visor aft as well as forward, and a khaki suit. His chin and cheeks were painted symmetrically with radiating red lines. On his chest and belly were more elaborate designs in blue, the details of which could be only partly seen through his open jacket. His hands were stained a brilliant purple-black, which contrasted startlingly with the ruddy skin of the wrists. We were told later that this stain is prepared from the fruit of a shrub called the *achiote,* mixed with powdered charcoal.

This Indian was a fine-looking man, dignified, well set up, and taller than most of those we met later. He was joined within a few moments by a son of about twelve, who wore a blue shirt above his breech-clout, and by a daughter, somewhat older, clad in a printed cloth wrapped around her waist and falling to the knees. The legs of the girl, from the ankles up, were dyed the same hue as the hands of her father. All three Indians seemed completely clean.

Next day on the same beach I photographed two small Indian children. They were with their mother, whose permission I obtained to use the camera. The women asked me the cause of the red and peeling blotches on my bare legs. When I explained that the unsightly condition had been caused by the rays of the tropical sun, I felt doubtful whether sunburn was anything that she was capable of understanding.

Another unanticipated meeting occurred at the mouth of the Rio Coredó, Colombia, on the afternoon of May 18. By good luck Comandante Fallon and I landed from "Askoy" in a bongo just as two Indians were wading across the mouth of the stream. One was a man in early middle age, the other a handsome lad in his late 'teens. The youth looked like a bit of a dandy because his "hair-do" included a lock meticulously dressed down the middle of his forehead. His throat and the lower part of his face were painted a uniform red, and his teeth were stained a shiny black. When I called a greeting, both Indians advanced to meet us and we solemnly grasped hands. Cristobal Colón himself could not have been welcomed more graciously by the aborigines of the New World.

After exchanging a few amenities, I asked the privilege of being photographed with them. Subsequently it was quite agreeable to them to be snapped alone, and the boy also permitted me to make a close-up of the cryptic designs tattooed on his left forearm.

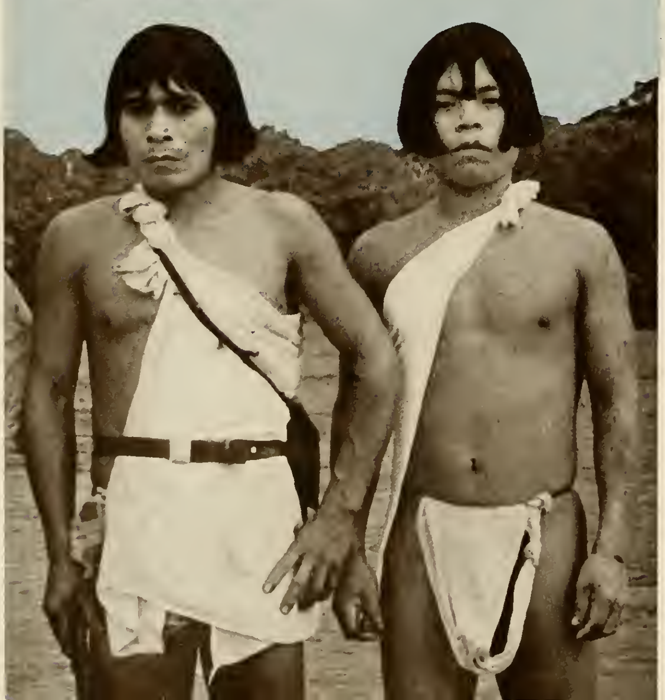
Our next glimpses of the Chocoanos were at the beautiful Ensenado de Guayabo Chiquito. At the time of our first call, in March, I remember particularly the admirable sight of a sharp-bowed, red-and-black canoe shooting through heavy breakers under control of three young women clad only in bead headbands, girdles, and loin cloths. They remained standing in their cranky little craft while it surfboarded ashore on the forward slope of a roller. At the last moment they leaped into the foamy water with perfect synchronization and carried their dugout high and dry.

All of the foregoing gave no more than a tenuous touch with Indians, but on May 3 I had an opportunity to talk at length with two boys belonging to the extensive colony of the Chocó in the delta of the River San Juan. Through the courtesy of the Colombian War College, I was invited to accompany a military mission on a one-day voyage from Buenaventura to the *pueblo* of Palestina. We left the pier in Comandante Fallon's gunboat "Junín" at three o'clock in the morning, and were blessed by what passes for a fair day in the Chocó. This means that heavy showers were well dispersed and that in the intervals we enjoyed blue or silvery skies, rainbows, brief displays of sunshine, and the frequent sight of flickering golden patches on the ocean even while our vessel was receiving the full force of a squall.

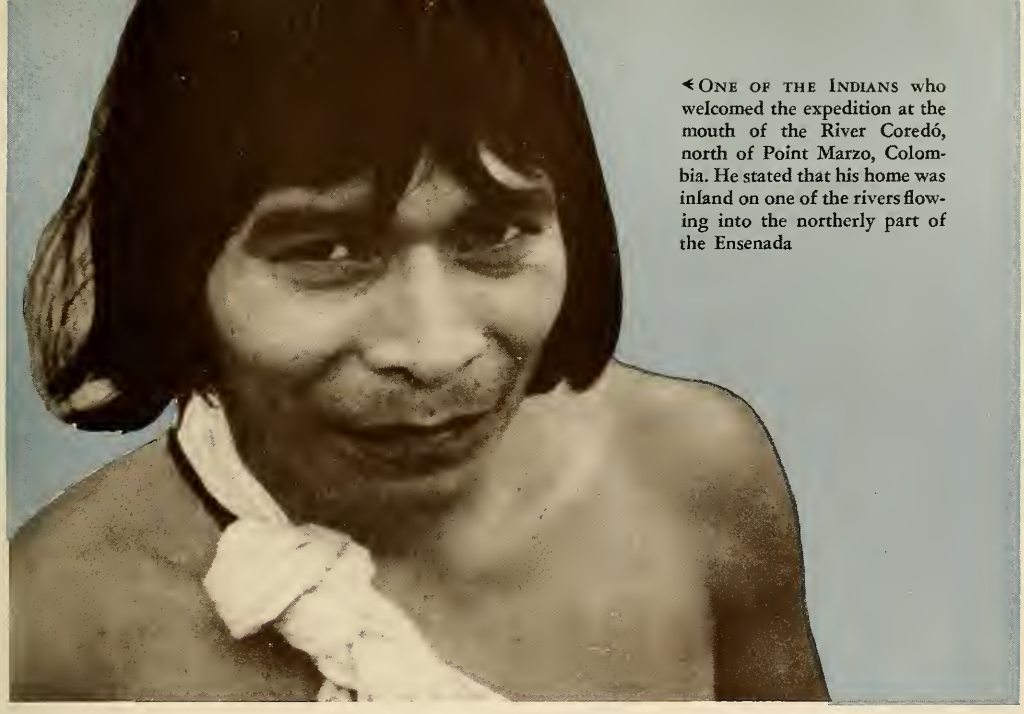
Just before seven o'clock we came to the outer bar of the great river, which we entered through the most southerly of its eleven mouths, known as the Boca San Juan. *"Braza y tres quartos"* (a fathom and three-quarters), sang the sailor who hove the lead. Then "Two," "Upwards of two," "Two and a half"—and "Junín" had safely crossed. Thereafter the water deepened rapidly to four fathoms, and we increased speed. There were, however, further shallows inside the entrance, and the commander on the bridge had a tense expression as he stood at the control and listened once again to the announcement of soundings. This time we went to a "Fathom and one-quarter, *scarce*," the very draft of the vessel, before passing permanently into the safety of the river bed.

Presently we began to see establishments of the Indians along the banks. Some of them were large and more or less communal houses, without walls. Open dwellings of this type always meant Indians; whenever we saw a hut with planked or plaited walls, binoculars invariably revealed its occupants as Negroes. As we steamed along in midstream through the grayish-yellow current, we could watch large numbers of men, women, and children seated on the high floors under the shade of palm roofs. Most of the people were nearly nude, and their bronze skins had a warm glow, especially when accented by the strands of brightly-colored beads around the necks of many of the men. In front of the houses, from two to a dozen spoon-bowed *cayucos* were usually moored to the shelving shore by poles thrust through a hole in the forward overhang. We soon began to find Chocós on the move in similar canoes—a young woman paddling along the margin of the river with utmost grace and apparent lack of effort; two wholly naked boys disappearing into a reed-lined *estero*; two men with bones stuck through the septum of the nose, standing and paddling at either end of a precarious little dugout and endeavoring to catch

➤ Tiberio, a young Chocó Indian of the San Juan delta. His neck is encircled with many strands of small beads in four colors



∨ Two Chocó Indians of the Ensenada de Coredó whose faces are also shown elsewhere. Each man carries a shirt which, however, he prefers not to wear while traveling. A "diplomatic pouch" suffices for baggage. The machete and knife are necessary parts of gentlemen's equipment



◄ One of the Indians who welcomed the expedition at the mouth of the River Coredó, north of Point Marzo, Colombia. He stated that his home was inland on one of the rivers flowing into the northerly part of the Ensenada

"Junín." They failed by a narrow chance, and I saw in the bottom of their craft three bowls of eggs which they had doubtless wanted to sell to our ship's cook.

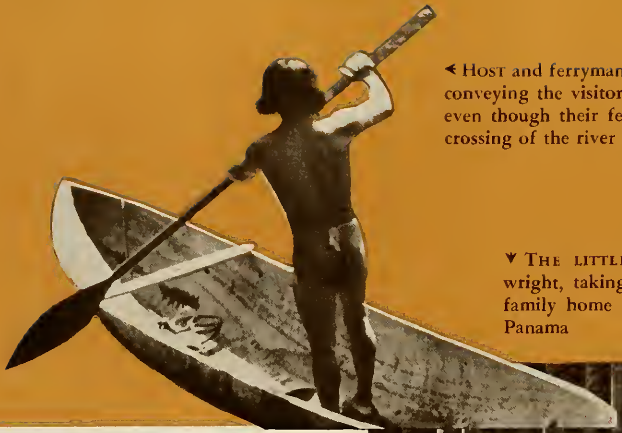
For a time the river widened upstream and, we entered a district of low alluvial stretches where the cultivations of the Indians could be made out clearly from deck. These included sugar cane, corn, bananas, pineapples, yuccas, papayas, and other crops. The plantations stretched in narrow bands alongstream, extending only a few yards back from the water's edge. Sugar cane no doubt satisfies a demand for quick energy-producing food. In one laden canoe, manned by half a dozen women, I saw the bow paddler stop to pick up a length of cane from her boat, and with a machete hack off a section which she thereupon proceeded to chew while she worked. Many *cayucos* 35 feet long, or more, appeared to be conveying whole families from one abode to another. We counted as many as ten individuals in one, besides the heaps of baggage.

It was amazing, after our experience elsewhere in the Chocó, to see so many Indians and so few Negroes. Anthropological literature on the region records that the blacks have already appropriated the greater part of the San Juan Valley. I learned later, however, that this applies chiefly to the middle reaches of the river and its main tributaries. The delta, between Palestina and the mouths, together with the remote headwaters of the river system, are still almost exclusively Indian.

Near the junction of the San Juan with a side channel known as the Brazo Cabeceras, two Indian youths paddled out from shore with desperate energy, intercepted us, caught the handrail of the main deck, and hung on, while "Junín" was making ten knots. The maneuver was as skillful as anything that could be imagined in the way of small boat handling. One boy stood at each end of the narrow canoe, which was about 25 feet long and had to approach our gunboat practically head-on across the bow-wash before it could swing parallel. After using a similar *cayuco* throughout four subsequent summers on Long Island, I can appreciate all the more the amazing boatmanship of the Indians, which can be a product of nothing less than daily practice from babyhood.

The boys made fast their craft with bark ropes and remained standing with one hand on our rail, prepared to complete their upstream journey in their own bottom which was rushing furiously through the white water alongside. When they were invited aboard by the Army officers, however, they at once clambered through and joined us on deck. It turned out that they were headed for the store at Palestina to buy a new shirt apiece, for which purpose each boy had a peso note in his breast pocket. Shirts, by the way, are more or less semiformal garments among the Indians. They don them when they are about to enter the company of black folk or white. If they were to visit the streets of such a real metropolis as Buenaventura, they would make further deference to convention by slipping on trousers over the breech-clout.

For more than an hour I conversed with these boys, with the aid of my Colombian military friends. They were brothers, Tiberio and Neldo Mercazar, about 19 and 16 years old. But neither knew his age; neither could read or write; neither knew who was president of Colombia, nor anything whatsoever about the political affairs of the country. Neither knew that there was a boundary between Colombia and Panama. In other words, they were wholly independent human beings in an ancestral land that was still their own. Both were grave and reserved, and when a questioner asked something designed to be amusing to the rest of us, the boy addressed replied so simply that he was not the one to be laughed at.



◄ Host and ferryman at Cocalito. He insisted upon conveying the visitors back to the beach dry-shod, even though their feet were still wet from a first crossing of the river higher upstream

▼ The little daughter of Maestro Chucutí, the shipwright, taking her siesta on the sleeping platform in the family home on the shore of the Ensenada de Guayabo, Panama

They had identical mops of black hair, bobbed off as evenly as if trimmed around a porridge bowl. All the area below had been shaved or clipped close to the skin. Each boy wore around his neck several thick ropes of small beads which were yellow, red, light blue, and dark blue. Neldo said that his beads, which weighed slightly more than a pound, had cost four *pesos* ($2.00). The Colombian officers stated that the beads were of German manufacture. The boys looked as though they wore nothing but their shirts, but hidden under the tails were a red breechclout on one and a yellow on the other. Their skin was clear and ruddy, except that the legs and feet were spattered with small scars, the record of countless scratches of the jungle. Tiberio had twelve holes, in rows of three, bored or burned through his right thumb nail, each showing a circle of the quick underneath. He would make no replies to several questions regarding the significance of these. Both boys had large holes in the lobes of their ears, but these bore no ornaments at the moment.

Tiberio and Neldo each smoked a cigarette or two when invited to by the military men. They asked for nothing, however, and behaved as gentle guests, answering questions willingly with the exception of several concerning their native language. For some unknown reason, both boys said that they spoke only Spanish, which could not be true. One of the Colombian officers who had some knowledge of the two Chocó dialects had heard them shouting advice or commands in their native tongue during the hectic moments before they succeeded in grasping our rail. When we asked them what the Indians called themselves, they replied "Cholo," the same answer that was given us everywhere between Darien and the San Juan. They told us that many Indian children in the delta had recently died of the *tos ferina* (whooping cough). We passed one cemetery in the forest on a stretch of high river bank, and among the jumble of toppling wooden crosses was a cluster of small new ones still standing upright. Most of the Indians are nominally *cristianos*, though relatively few see the inside of a church throughout their lives.

Tiberio and Neldo had no interest in our cameras or field glasses. I am certain that one of the boys took in a well-focused view of the river bank through my own binoculars, but it was quite clear that he saw nothing advantageous in the trick. I suspect that both of them grasped the meaning of a military chart of the San Juan delta when an officer pointed out

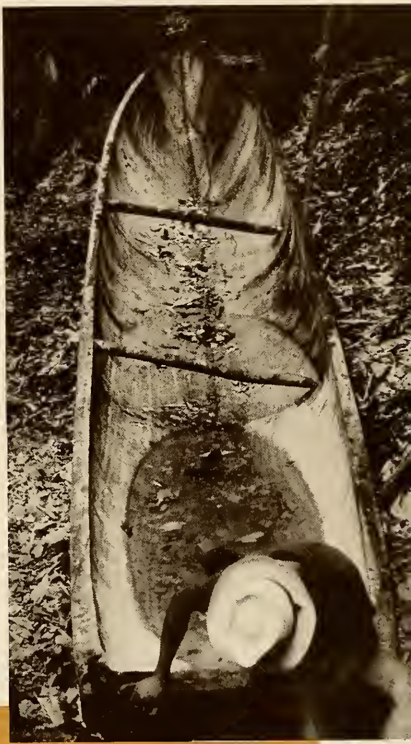
the very waterways, junctions, and hamlets that we were then passing.

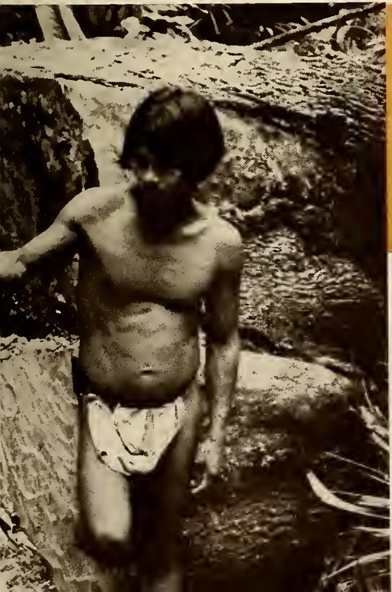
But it remained for a major of aviation to break down the guard of the boys and to throw them into a state of frank and unmistakable astonishment. This he did by demonstrating a gadget on his riding boots. These were an old pair, for which the calves of his legs had grown too stout. He had therefore had a bootmaker in Bogotá slit them down the back, from top to heel, and sew on zippers. When this officer raised his foot to the ship's rail, called the attention of the Indians to the back of his leg, then ripped his boot open from top to bottom and as quickly mended the rent, the complete bewilderment of Tiberio and Neldo was comical to behold. They took no share in the joke, however, but maintained a countenance of such grave mystification that it was impossible for gentlemen to laugh.

Upon our return to Guayabo Chiquito on May 20, we had an opportunity to establish more intimate relations with a number of Chocó Indians. Shortly after dropping anchor for the second time, we received a call from a small and wiry Indian named Chucutí, and his young son, Brigido. Chucutí was a boat-builder, and the two had come to "Askoy" in the most beautiful small salt-water canoe I had yet seen. With all the air of a squire on his own estate, Chucutí invited us to his home. Since we had no tender suitable for landing through the waves of an open coast, don Antonio Maya Cardona, who had a trading post at the Ensenada, hospitably supplied us with a beautiful surf bongo, sharp at both stem and stern, and with two expert Negro boatmen from Quibdó to man it. Comandante Fallon and I, with our cameras and light-meter packed in waterproof bags, sat in the bottom of the bongo. The bow boatman rowed with one long oar; the helmsman used a seven-foot leaf-bladed paddle on the other side. It was simple going until we came to the landing *playa*, where the surf was piling in. There our boys waited until a series of big waves had passed. Then they pulled and pushed hell-bent for shore. We rode in superbly, were cast up on a wave that broke without flooding a drop over our gunwales, and none of us was wet above the ankles while attaining dry land.

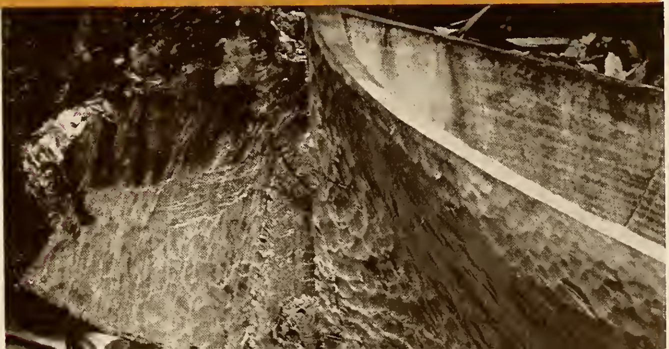
Our host lived in a house with a beautifully plaited *paja* roof, just behind the crest of the beach. Barrigón ("Pot-belly"), the grandfather, came down to greet us. He was misnamed, for, as they say in either English or Spanish, he was a fine figure of a man. Chucutí had not beached his own canoe until he had seen us safe ashore. Arquimedes, a fifteen-year-old son of Chucutí, showed a regrettable touch of sophistication, because, before taking part in the welcome, he ran up to the house to put on a sweater, a felt hat, and a belt that held up nothing. The other men and boys rested content with their g-strings. Arquimedes was therefore the only one who looked incongruous, with the jaunty hat from Panama almost resting on wooden plugs in the lobes of his ears, and wearing nothing below the hips except his many-colored breech-clout.

We climbed the seven-foot notched pole to the floor of the dwelling and were invited to be seated. Since there





◀ **Chucutí**, his elder son, Arquimedes, and the 31-foot seagoing craft which the Maestro had carved from a single tree trunk in the heart of the Darien forest. The boat was still attached at bow and stern to the log from which it was being hewn. Chucutí was only five feet tall, and, although he was strong as well as competent, there were indications on his torso that in childhood he had suffered from rickets or some related nutritional deficiency



were neither chairs nor stools, the floor was the answer, so the *comandante* and I joined the family circle. At my left was Chucutí's wife, bare from the waist up, within a month of producing a sixth child, and sublimely indifferent to the revelation of either fact.

At one end of the house a platform, measuring about eight feet by 20, rose a foot above the rest of the floor. This made the sleeping quarters. Above it hung a string of delicate shells and crayfish claws, which tinkled faintly when the air stirred. This, said Chucutí, was a bat-scarer to frighten off the nightly vampires. Arquimedes, Brigido, and the two younger sons were seated along the edge of the platform, and in the middle lay a charming little girl of about two, sound asleep. I could not help asking whether she was quite well, to which the father replied that the hour was merely that of her *siesta*. The hair of all the Indian children showed curious bleached streaks. Chucutí reported that his own hair, now entirely black, had been similarly pale when he was a child. I do not know whether the sun or some other agency is responsible for this condition, but I have since learned that bleached hair among the youngsters of both the Chocó and Cuna Indians has been widely reported.

After we had chatted for some time, I produced some trinkets which Mrs. Murphy had supplied against such great occasions. To Chucutí's wife I gave a necklace made of three strands of metal, and her eyes gleamed. Some additional Woolworth items went to Chucutí and the children, while Barrigón received a glass dog, guaranteed to keep all interlopers away from his residence. He enjoyed the joke, but obviously appreciated the precious crystal because Fallon had a hard time convincing him that it had not been handed him merely to look at. The whole family, with the exception of the sleeping daughter, then came down to the ground to be photographed, after which we took our leave. When the matron extended her left hand in parting, we were amused to hear her husband admonish her with a whispered "Right hand," just as we do to our children at home.

Chucutí and Arquimedes now launched the little surf canoe, and we followed in our bongo to another cove of the Ensenada, where Chucuí had a boat in the making. We landed below a bank on which the forest had been burned, climbed a hill through blackened tree trunks, the Indians leading, and followed a trail for more than half a mile into the primeval world. The sight that then met our eyes was one never to forget. A giant tree that had been well over a hundred feet in length lay prostrate. I do not know the species, but Chucutí called it a *jenené*, characterized by hard and enduring wood and much better for large craft than the espavé or wild cashew out of which he carved his smaller canoes. We walked along the enormous bole of the fallen tree, seven feet above the forest floor, until we reached the craft in process of being hewn out of the living wood. It was all of a single piece, 31 feet long, slightly more than six in beam, and about five feet high. Stem and stern were still attached to the vast log, but the interior had been carved out with perfect symmetry and the outside finished at least roughly from bilge to gunwales.

Under Chucutí's animated explanations, we learned the reason why the inside of such a boat is first brought to perfection. It seems that when the work is carried thus far, the builder bores series of holes about 2½ inches deep in the hull of his craft, after which the outside is carved away until each hole is exposed. Such is the technique for obtaining uniform thickness. After completion of the work, the holes are plugged with pegs, the positions of which can be seen in any large bongo built by an Indian.

Comandante Fallon, as an accomplished naval officer, knew a good job of shipbuilding when he saw it. He was as awestruck as I, and while he engaged Chucutí in a discussion of sheer, balance, buoyancy, and other nautical details, I aimed my motion picture camera. Three months of Chucutí's labor had already been expended on the bongo. When he finished it, a trail would have to be cut down the hillside, and skids of split logs built to slide the heavy hull to the water. Altogether, the Indian estimated, the task would require at least six months of his time. From this point we ceased to address the man as Chucutí and called him "Maestro" in recognition of the fact that he was a master shipwright.

This bongo was built not to use but to sell, and perhaps to be equipped with an engine. At the home of the Maestro we had seen a new single-barreled Stevens shotgun, listed in the United States at a price of nine or ten dollars. The gun was an advance payment on the bongo, given by a trader. After completion of his contract, Chucutí said that he was to receive, in addition, two boxes of shotgun shells, 200 percussion caps for a muzzle-loading shotgun, one pound of powder, one pound of lead shot, and a sack of salt. Weighing in my mind the two balances of this bargain, all I had the heart to say to the Maestro was that he was obtaining a very strong and reliable American shotgun for all his toil. He beamed at the remark, as we returned to the cove.

Before our final departure from the Ensenada de Guayabo Chiquito, I asked our friend whether we might not have something else on board "Askoy" that we could leave him as a *recuerdo*. The Maestro thought solemnly for a moment, and then stated that he would be happy to receive two fishhooks, a package of Epsom salts, and some quinine, if we could spare them. We could.

Cocalito or "Little Coconut Grove" lies only eight miles south of Guayabo Chiquito and is one of the few sites at which a Chocó Indian settlement reaches the seashore. Its persistence beside salt water is due to the double protection of trackless forests and beachless coasts for many miles north and south, and to the great rollers that break, even when the ocean is calm, against the sandy barrier across the mouth of the valley. On two occasions we had sailed "Askoy" close to this beach with the hope of making a landing, but each time the terrifying waves had dashed our hopes. With the kind aid of Señor Maya Cardona, however, we finally achieved success on May 21.

Before nine o'clock we were off the dancing spray of Cocalito, but this time our boatmen guided us toward a relatively quiet strand in a cove north of a small hilly peninsula. With Armstrong and Fallon, I crouched again in the bottom, and we oscillated just outside the combers until the right moment arrived. The secret of success was the speed that the long, lean boat developed under power of pole and paddle to outrun the next wave.

We trudged southward along the wild steep beach, which had a flat forefoot of shingle on which the surf was crashing. Along the crest of the dune, the Indians had wisely planted rows of young cocopalms that were flourishing hopefully in front of full-grown trees. The grove as a whole

◂ A CHICKEN HOUSE and roost on the Cocalito beach, built according to the same principles of construction as the homes of the people themselves

➤ A SMALL LASS OF COCALITO, who, a few moments before, had been in an almost complete "state of nature." Pulling on the finery demanded by so festive an occasion as being photographed had ruffled her hair but not her disposition

◂ THE COCALITO SETTLEMENT was full of the symbols of normal and happy childhood. Here is a toy boat of balsa wood, abandoned as cheerfully as though its owner were a small boy or girl at some water front in the United States

➤ CASIMIRO, the fish-spearer of Cocalito, a boy of about twelve years, who had an important part in welcoming the visitors from "Askoy." The aristocratic courtesy and graciousness of Casimiro would be a model for lads of his age in any community was so exquisite that nothing in Polynesia could surpass it. Shrubs covered with white blossoms, and others with red, stood among the swaying trunks, and on the side away from the sea the shadowed ground sloped down to the Río Cocalito. Behind all was the backdrop of the coastal mountains, where yellow and heliotrope crowns of vast flowering trees stood out against the mass of varying greens. There were two houses in the grove, both unoccupied but well filled with possessions, including toy boats and other belongings of children. Beside each one was a well-finished chicken house, standing on stilts and roofed with thatch. When we reached the edge of the rushing river, we saw that Indians were occupying four or more houses on the opposite bank. Several of the inhabitants had an eye on us while we inspected the property on the spit, so we sent one of our Negro boys as an emissary to request the privilege of calling at the settlement.

Half a dozen dogs of the Indians waded out to a dry bar in the river and barked at us, but at the same time they wagged their tails vigorously. Furthermore, they were clean and well-fed animals, and it was not long before I coaxed two of them into admitting that they had not really meant to bark at all. They felt, indeed, rather apologetic about it. From this I concluded that the people would prove worthy of their dogs.

The Indians were smiling and cordial. There were at least fifteen persons in the first large house that we approached, and everything in it was visible because of the absence of walls. In its accoutrements it probably differed very little from a Chocó residence of the days before Pizzaro. There was, to be sure, a well-oiled rifle on the rafters (for which some poor red man had doubtless been bled white). There were also a porcelain Buddha in one corner of the floor, a Singer sewing machine in another, and a five-gallon gasoline tin hanging above the three fire logs in an earth-filled square hearth, but nearly everything else had a primitive look. Rice threshing-rings of balsa bark, water gourds covered with carved designs, plaited fans for fire-reviving, and large bundles of white bark fiber were among the many objects suspended inside and under this dwelling.

Several men and women were at work around a canoe about 12 feet long which had been brought up to the high floor and filled to the brim with a brew of palm nuts and water. In answer to Fallon's questions, they explained that from this mixture they skim oil for cooking and then prepare a drink from the residue.

We told them that we had long wanted to land and call upon them. They remembered our maneuvers offshore in March, and had watched us from the dunes on our three approaches. They said that their latest visitor, except for a familiar trader from Panama, had been a submarine that had lain off the settlement about six months before, after making several dives and returns to the surface. Men in blue uniforms had finally come ashore in a boat drawn out of the back of the big craft and, after capsizing two or three times, had taken off several loads of water from the river. These men, they said, spoke a strange tongue that was not English. They were also impolite, and they had entered the homes of the Indians without even asking permission.

I asked the Indians whether any of them remembered a visit from Dr. Erland Nordenskiöld and his wife, Señora Olga, nearly 15 years before. One elderly woman, who seemed to be the matriarch of the community, appeared to have a dim recollection of this event, but I could not be sure. Then we began to talk about making photographs, and for a time Comandante Fallon was convinced that the people had no idea what we meant. I tried another approach by walking down to the river where a very handsome twelve-year-old boy was spearing fish from a canoe. He had already transfixed a snapper and was now darting at a *tamborero* or blowfish. I asked his name, addressing him as a *valoroso pescador* (brave fisherman), which amused him mightily. He was called Casimiro. Then I pointed to my 16-mm. motion-picture camera and told what I wanted. At once he struck heroic poses with his fish-spear, held up samples of his catch, and showed forthwith that he knew something about the cinema.

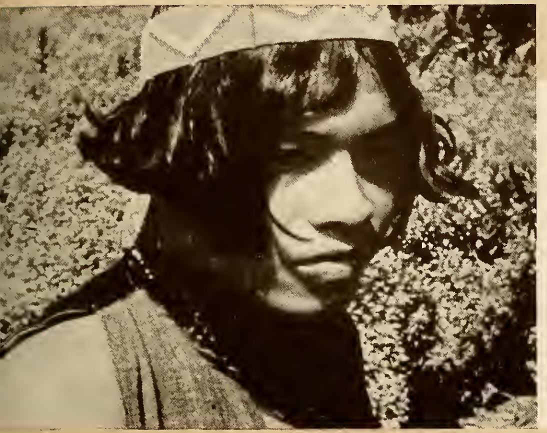
Comandante Fallon had an Irish great-grandfather from whom the charm of the Blarney Stone has descended. The effect of his running and irresistible harangue, together with that of watching me use the camera on the boy in the boat, produced a magical change. All the Indians suddenly went Hollywood! Chests and bags were opened and finery was yanked out. There were vehement smoothings of hair, snapping on of bead and coin necklaces, encirclement with garments like Joseph's coat, hooking in of earrings, donning of embroidered vests. The more vociferously we admired, the more delighted were our hosts, and within five minutes they all marched out from several houses into the tropical sunlight and lined up, even to babes in arms. We thereupon photographed the residents of Cocalito, both collectively and individually. Later we all entered the large house again and devoted ourselves wholly to conversation. Under the shadow of the low eaves it was too dark for photography, but we had an opportunity to learn that gaiety and merriment were no less characteristic of these people than their courtesy. The women went no further than to smile, but the men frequently broke into the heartiest of chuckles at the fluent sallies of Fallon. After a little encouragement, two of them were persuaded to bring out a bundle of ceremonial wands or maces, the carved figures on which seemed to me, however, to represent an African, rather than an American Indian, motif. It is possible that during the past three centuries the cult of the Negro has had its effect even upon a group that stands rigidly apart.

I paid all possible attention to the many children, including a baby of about four months, the daughter of a very pretty mother. Before long one little girl of three years was willing to sit beside me most affectionately, to the somewhat surprised amusement of her parents. She wore only a red, blue, and yellow g-string which hung down in front almost to her ankles, and of which she seemed inordinately proud. When I pulled out of my haversack another of the "gold" necklaces, so thoughtfully supplied by my wife, and locked it around this child's neck, she was utterly entranced and thereafter followed us about with winsome smiles.

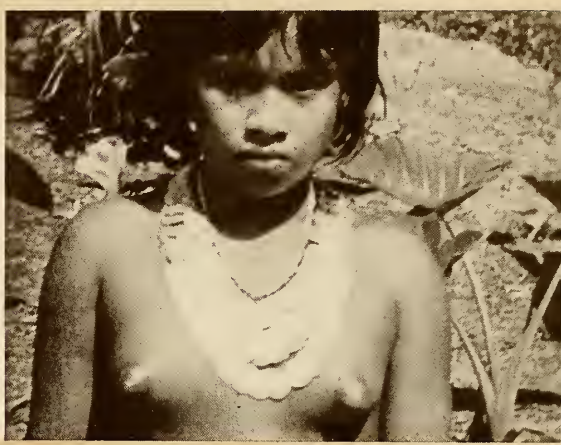
Some of the names were obviously purely Spanish, while others apparently belonged to the native tongue. One of them, "Comogre," was interesting because a *cacique* or chief of the same name was known to Vasco Nuñez de Balboa, in Darien, in the early sixteenth century.

When we left, our Cocolito friends attempted to load us down with baskets of fresh eggs, but we thanked them and explained that we had taken on at the Ensenada de Coredó more eggs than we could well consume on the remainder of our voyage to Pan-

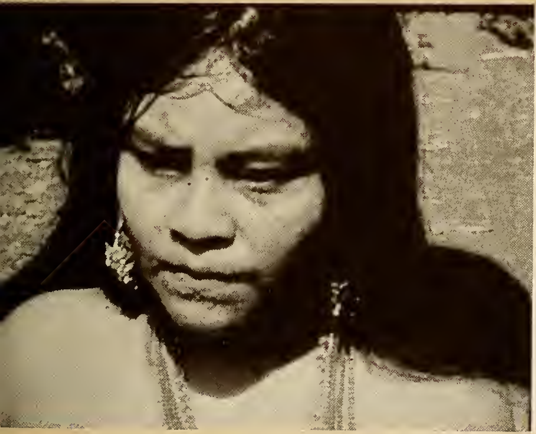
Three men and three women of the Cocalito settlement show faces that range from narrow and aquiline to broad and rather flat. In different costumes one or another of these persons might pass for other native Americans, such as Algonquin or Eskimo. The bead bands and strings, and the silver earrings are native handicraft



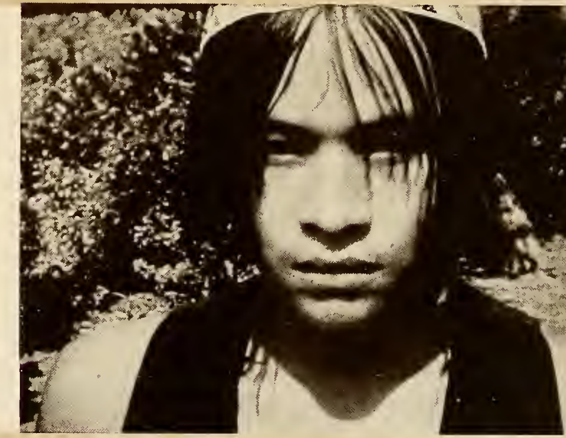
▲ Two men wore ordinary "store vests," which were, however, elaborately embroidered with ceremonial designs



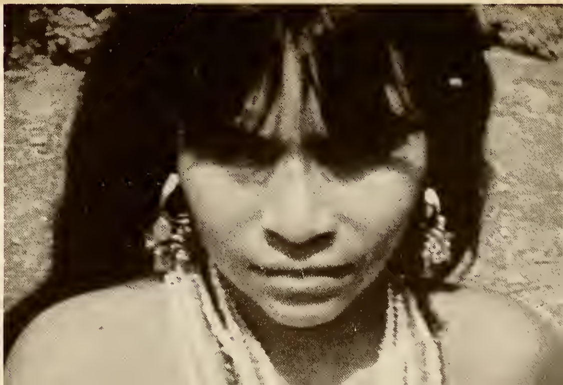
▲ This necklace is of Ecuadorean silver coins, traded northward through hundreds of miles of tropical forest



▲ Drops of perspiration on this woman's face were probably due to embarrassment rather than the temperature

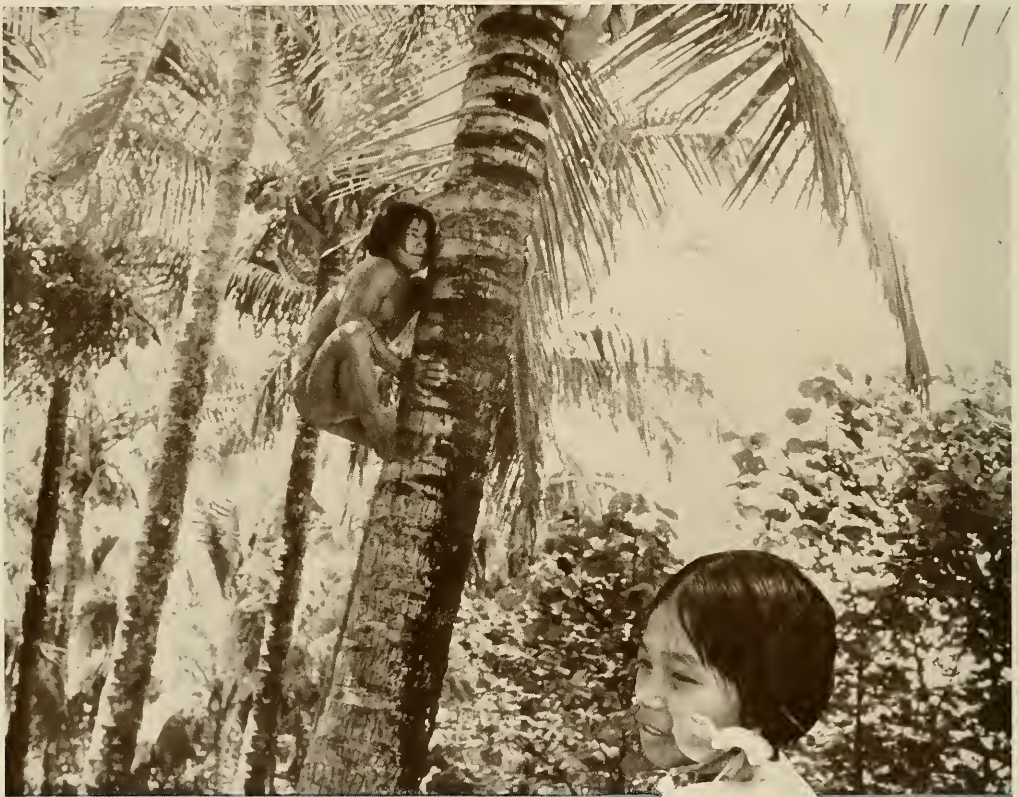


▼ This charming young Indian woman was the mother of two or more children. Note the elaborate silver earrings

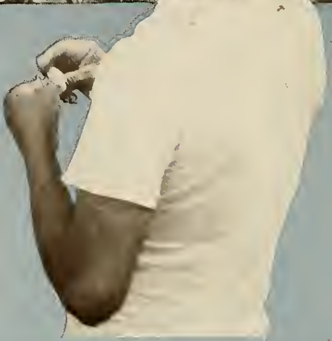


ama. We had learned in advance that the Indians regard tinned fruit as a luxury, so we left them a small supply with which the generous Maya Cardona had supplied us for the purpose.

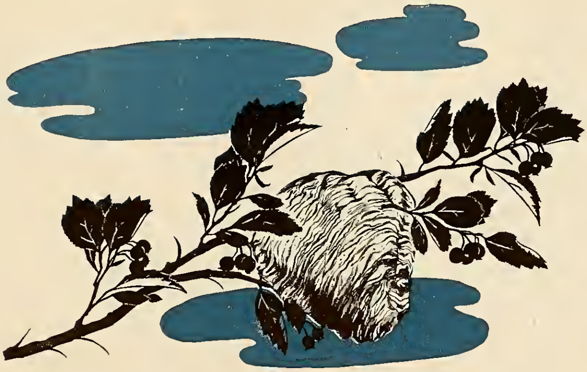
Our black boys were permitted to wade back to the beach across the Río Cocalito, but not Armstrong, Fallon, and I, even though our feet were still wet from the former crossing. One of our hosts insisted upon transporting us in his shapely canoe to the far side. There we said farewell, climbed the dune which was carpeted with pink morning glories, and waved to the boatman who was paddling back to his home. Another man and Casimiro took a short cut to the little beach where our bongo was hauled out, in order to see us off with proper ceremony and to supply us with green *pipas*, for which the man had climbed a tall coconut palm. Casimiro had by this time adorned his left ear with a brilliant red hibiscus blossom. On the way out to "Askoy" our Negro helmsman summed up our own opinion of the Indians, even though there was incongruity in his words. He said, *"Buena gente; muy castellana"* (Fine people; very Castilian). It was the perfect compliment.



▲ Vertical travel presented no difficulty to the gentlemen of Cocalito, who supplied the expedition with an abundant gift of green coconuts to take back through the surf to the schooner. This man went up the tall palm squirrel-fashion, without aid of a loop or any other device



➤ Before accompanying the visitors from "Askoy" to the beach where their surf bongo was launched, young Casimiro dressed up in a white shirt and thrust a gorgeous red hibiscus blossom through the perforated lobe of his left eat



PAPER CASTLE IN THE AIR

By Roy L. Abbott

A WORKER wasp of the genus Vespula—the kind known as the bald-faced hornet—was making her first hunting trip of the day. Since dusk of the night before she had remained quiet, along with her numerous sisters, in the home nest, a paper castle in the air. It was a gray, half-bushel-size Chinese lantern sort of thing, hanging lightly from the end of a thorn apple branch perhaps 200 paces from where she now was.

Hungry from her long fast, she quested patiently for some insect upon which she might pounce. Her thick black and partly yellow-banded body, three-quarters of an inch long, gleamed in the sun as she flew slowly back and forth low over the tops of the weeds. She hunted, it seemed, chiefly by sight, but although her great eyes made up a large portion of her head, they were apparently best adapted to close-range work, for several times she darted upon what appeared to be a victim only to have it turn out to be a bit of wood or a dark spot upon a leaf. But she made no mistake when she swooped like a hawk upon a big blue-bottle fly whose body showed sharply clear against the freshly cut surface of a stump.

Sweets were the diet usually preferred by "Vespula" (if we may give the individual wasp a name to which all members of the colony are entitled). But now, as if hunger for flesh had for the moment overwhelmed her, she seized the fly and winged her way to a near-by twig. Unlike her cousins the solitary wasps, which anesthetize their victims by stinging before dragging them to their nest, Vespula killed her prey by biting. She tore away the fly's head and wings and legs and abdomen, before finally regaling herself upon the remainder—the solid muscles of the thorax.

She did exactly the same thing with her next victim, another blue-bottle, except that this time she did not eat the remains. Instead, she carefully chewed the fly's heavy thoracic muscles into a pulpy mass, and holding this ball of flesh—a sort of insect-burger, so to speak—firmly in her jaws, she sprang into the air and headed for the home nest. Hundreds of her sisters had also been abroad that morning, and soon she found herself merely a unit in a great double stream of wasps traveling to and from their paper castle. It was as if the nest were a great hangar, and each worker wasp a transport plane. Some, laden with supplies, were delivering their burdens, while others, having discharged their cargoes, were now setting forth on a new trip.

But not all of Vespula's sisters had been on the hunt for meat that morning. Adult wasps eat a great deal of sweet foods, particularly fruit juices, sap from trees, and nectar from flowers, and even now some of these home-going foragers were heavily gorged with such provender. On arrival at the nest, they would disgorge most of this to feed the queen and nourish those workers that had remained behind to do the general housework of the castle and to act as nursemaids for the developing brood.

Still others, who flew along with Vespula on the homeward trip, carried neither meat nor plant juices. Instead, each bore in her jaws a dark pellet, a mass of paper pulp; for these workers were the paper makers, the nest builders, and general repair squad. Save for the first tiny comb that the queen herself had contributed, these workers in wood pulp had built the whole great paper castle, and it was their present job to keep it in repair and make whatever additions were required.

Their paper-making process was simple. All that was necessary was to find a bit of weathered wood, say an old fence rail or post, chew up a mouthful of this, all the while mixing it well with saliva, and the ball of gray pulp thus produced was ready to be spread. Once at the nest, the paper gatherer simply placed her wet ball of pulp against an unfinished surface—the edge of a comb or a wall of the nest—bit it sharply to fasten it in place, then walked slowly backward, smearing it out into a long thin strip which required only a further bit of patting and biting to smooth it into permanent form. And then away for another load. Thus had the whole castle been constructed.

When Vespula arrived with her

cargo, she entered the castle's one and only gate—a two-inch hole near its base—and climbed rapidly up the inside of the wall to the top floor. For, strangely enough, although appearing from the outside as if it were one great hollow shell, the castle really was a huge tenement house with five floors. Each floor consisted of a circular comb nearly a foot wide, suspended from the one above it by strong paper columns. Stranger still, when Vespula reached the top floor of the castle, she had really arrived only at the first floor, for in this topsy-turvey home of the wasps, the top floor or comb had actually been built first. The second floor had been added below it, and so on down to the fifth and last. It was this interesting fact that had led the Laputan philosopher, in *Gulliver's Travels,* to suggest to Gulliver that men should build their dwellings in similar fashion—first build a roof, he said, and then add the rest down to the basement as needed.

And delightfully consistent with all this "upsidedownness" was the arrangement of the castle's floors or combs. For unlike the combs of the honeybee, which are double and placed vertically so that the larvae lie in a comfortable horizontal position, those of the wasp castle were single and bottom side up, so that the eggs and young larvae had to be glued to the bottoms of their hexagonal cells in order to remain there. The largest grubs appeared to hang precariously only by means of their wide heads, which apparently wedged them in.

But Vespula and the two or three dozen other workers who chanced to be on that floor for the moment, and whose task, like hers, was to feed the larvae, apparently saw nothing queer in the arrangement of things. Upside down and with a meat ball in her jaws, each crawled slowly across the comb doling out her "insectburger" bit by bit into the mouths of the hungry grubs. It was a seemingly endless job, requiring many long trips daily for each huntress, but it was not entirely without compensation. For unbelievable as it may appear, the worker wasps—as is also the custom among their relatives the ants—exacted a toll from the larvae in return for the food given them; the toll is a sweet and abundant salivary secretion given off freely by the larvae, usually in response to a mild biting or tapping of their faces by the workers. This strange "you feed me and I'll feed you" relationship was probably the strongest of the ties that bound the wasp colony together.

The fat helpless grubs which Vespula was feeding appeared utterly unlikely ever to become vigorous, 6-legged, strong-winged, pugnacious creatures like herself. Yet barely two weeks before, each had been only a tiny, white, fertile egg, glued there to the bottom of its cell by the queen mother who had produced it. Now, as full-grown larvae, each would spin for itself a silken cocoon, the upper end of which would serve as a cap to the cell. Here, in the privacy of its paper case, each would unwittingly perform all those marvelous chemical and physical changes necessary to transform it from "worm" to fully developed insect. And when it had finished the nearly month-long tenancy of its cell, that cell would be quickly renovated by a worker and prepared for a new occupant. As long as the queen reigned, there were no empty cells in this paper castle of the air.

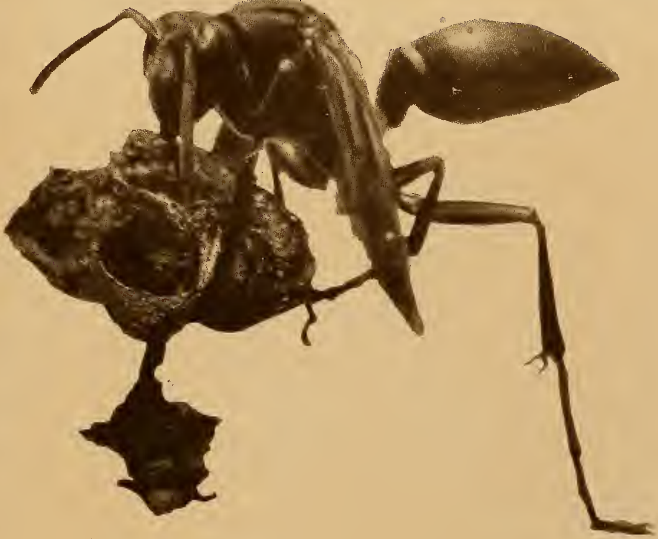
But all these wonderful transformations from tiny egg to winged adult insect were hardly more remarkable than the changes that had taken place in the castle itself. Now, in the month of July, it was a more or less heart-shaped bag, 16 inches long by perhaps a foot wide, swathed in gray folds of paper like an oriental turban and peopled by many hundreds of industrious, warlike citizens. But in early spring of that year, it had been scarcely the size of a golf ball with a short funnel-like extension at the bottom and with no inhabitants save the queen who had built it. And but a month before that, even this golfball-size structure had not existed except potentially in the body of the queen, who at that time, in the manner of all social-wasp queens, lay dormant and half-frozen in the center of a pile of cordwood, her jaws firmly gripping a hickory splinter as if in pathetic fear of being carried away while she slept.

Warm days had finally come, however, and the queen had at last roused herself and ventured forth from her winter's hiding place to feed in the sunshine upon the early spring flowers. She had been born in the late summer of the year before, and since she had hibernated shortly after mating, she had never had any experience in paper making, nest building, or in raising a family. But, as John Burroughs put it, "Nature had been wise for her," and she soon set to work gathering wood pulp, with which she built a small circular comb. This contained a dozen or more cells surrounded by a spherical wall of several envelopes of paper. The whole beautiful structure, the so-called queen nest, hung like a tiny paper lantern from the tip of a thorn apple branch. In each cell, she placed a fertilized egg; and when these had hatched into larvae, she made many long hunting trips to capture insects upon which to feed them. And when this first brood of worker wasps came forth from their cocoons to take over affairs, the paper castle in the air may be said to have had its real beginning. The tiny "queen nest" had been its cornerstone, so to speak, but from here on the ceaseless labor of this first brood of workers and many succeeding ones had brought the castle inch by inch and by way of constant remodelings to its final great size.

But from the very inception of this paper castle in the air, tragedy (at least from the human point of view) had been inherent in the lives of its people. For Mother Nature, far more niggardly in her gift of days to the wasp tribe than she had been to their near relatives, the ants, had granted, even to the queen wasp, a life span of only a year, and to Vespula and her fellow workers, only two or three months. True, as if in compensation, she had allowed the colony, in late fall, a brood of drones and queens, and these had set forth to mate, the males to die in a few days after mating, and the fertile queens to hibernate over winter.

Yet this brood of young males and queens—the only hope of this colony and of others like it—had hardly matured before the old queen died, completely exhausted from her labor of laying some ten thousand eggs. And following her death, Vespula and the rest of the remaining workers died one by one, many never returning from their final trips after paper or food.

Thus it came about that in late October not a wasp sallied forth to challenge the human observer who stood close under the thorn apple and tentatively and somewhat timorously touched the great nest with a stick. For the paper castle in the air was then deserted, and the wasp population of that neighborhood existed only in the bodies of the hibernating queens who, hidden away in a hundred out-of-the-way crannies, waited the coming of another year.



The life cycle of a Paper-Making Wasp

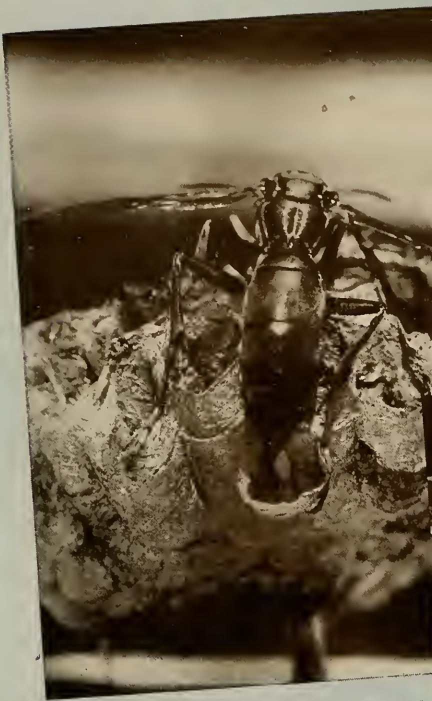
By Paul Griswold Howes

Curator, The Bruce Museum, Greenwich, Connecticut

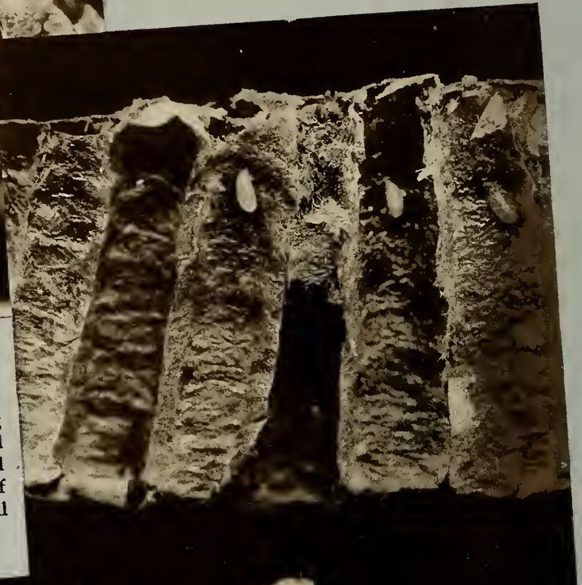
Wasps made paper from wood pulp long before man did. The procedure is a routine part of their nest-making and therefore forms a vital feature in their reproductive cycle. The following photographs show the process as conducted by a member of the genus *Polistes*. The first photograph is of a living insect, as are those of the larvae, pupae, and eggs. The others are from dead or torpid insects

▲ In the spring, fertile queen wasps scrape balls of pulp from old weathered lumber or dead limbs of trees, to make their spring brood nests, small in the beginning as shown in this photograph. Actually the wasp works upside-down, but the photograph has been inverted here so that it may be studied more conveniently

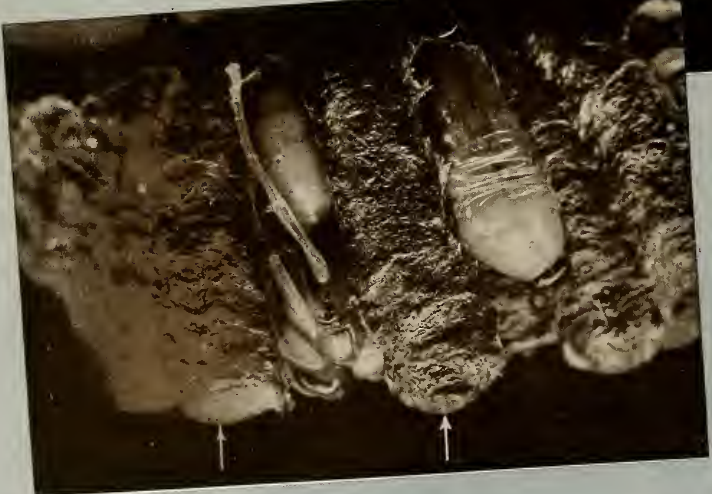
The background of this page shows how a weathered bit of lumber looks through the enlarging camera after a wasp has scraped it for wood pulp



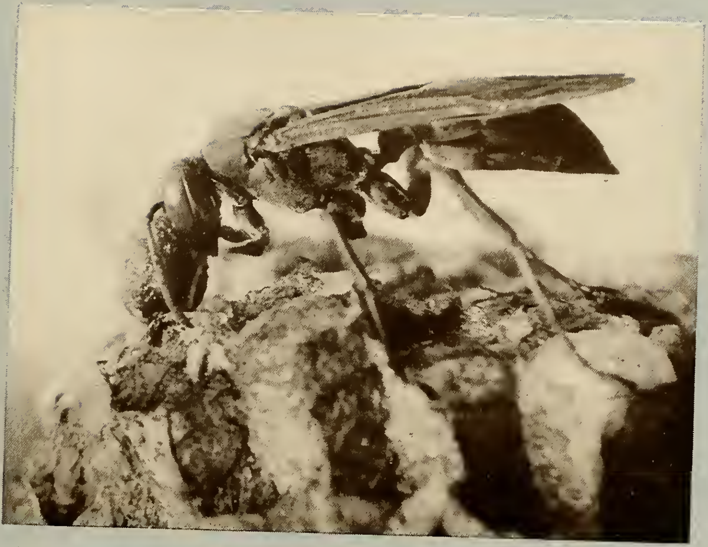
◄ THE QUEEN, having been fertilized in the fall and hibernating in that condition, lays her glistening eggs in the paper cells she has fashioned, one in each. She raises this first brood herself, feeding these young from day to day on such delicacies as nectar and chewed-up insects. Here again the photograph has been intentionally inverted



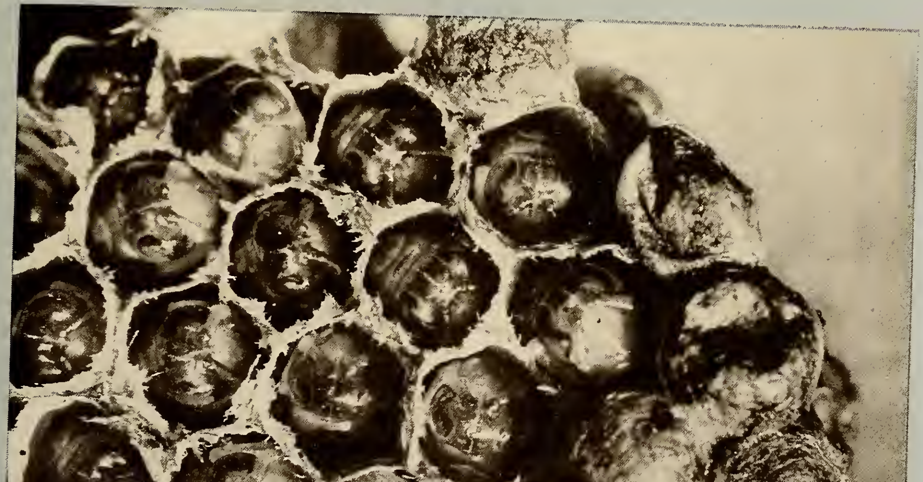
➤ AFTER THE FIRST brood of workers is raised by the queen, she ceases work on the nest and confines herself to egg-laying. All other labor is attended to by her first and succeeding broods of workers. Here we see an opened and much magnified nest containing several eggs. Note the coarse but strong texture of the wasp-made paper, which withstands all kinds of weather



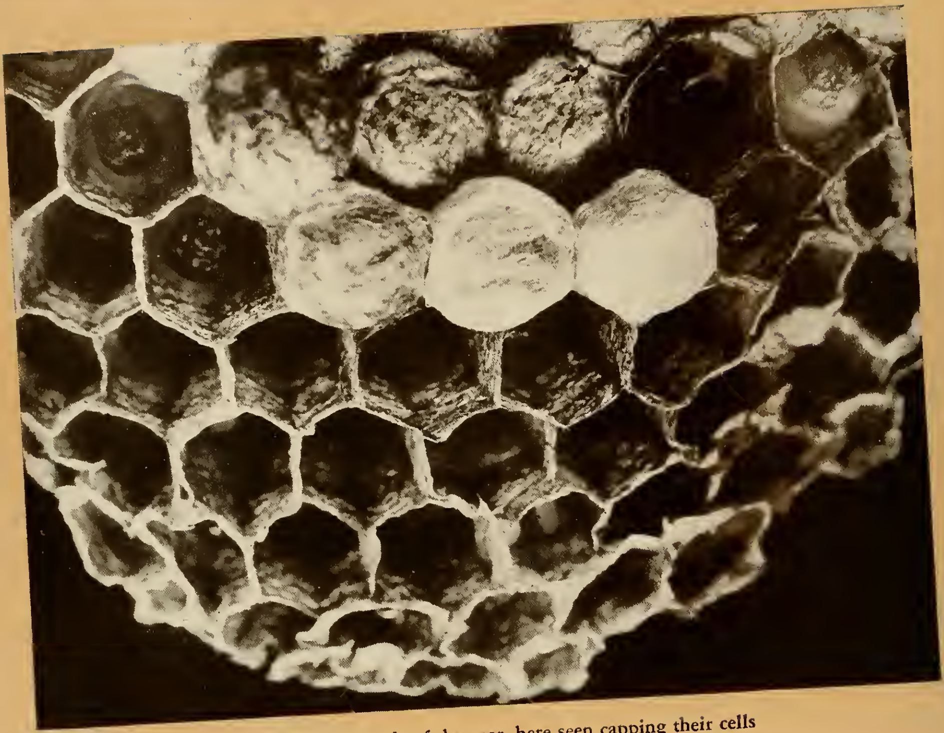
◄ YOUNG WASPS are footless grubs (*right-hand individual*). After they are fed for some time by the older wasps, they turn into pupae—delicate and soft, but otherwise perfect wasps (*left-hand individual*). The full-grown larva, before changing into a pupa, caps the cell with silk, as indicated by the arrows



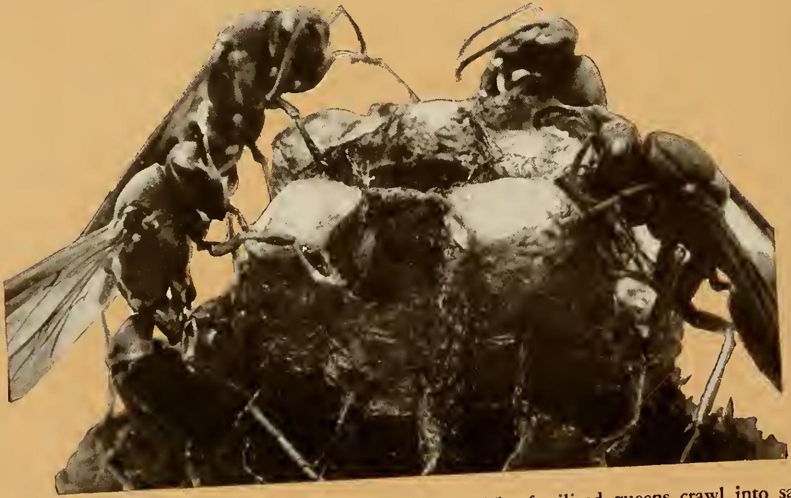
▲ As the colony grows, the busy workers continue to add paper, cell after cell, to accommodate the queen's many eggs and offspring. Here is a worker that has just arrived with a large ball of wood pulp, which, when mixed with the insect's saliva, becomes tough gray paper. The photograph is inverted



▲ By mid-summer the paper cells are crammed with larvae, each of which must be fed every day and many times each day. Still more broods mature and pitch in to help; but now fall is approaching

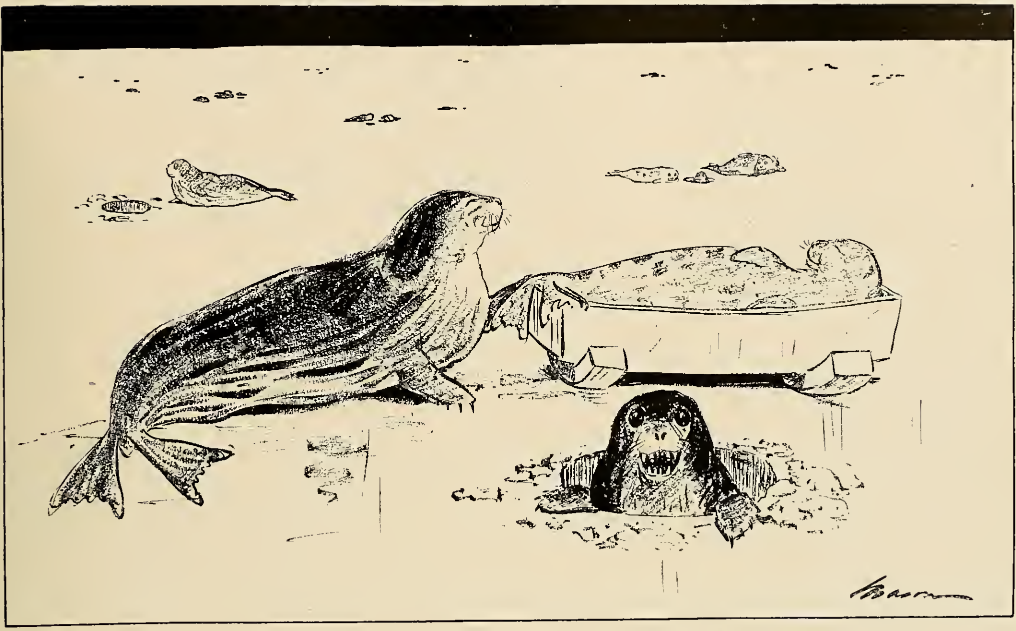


▲ THE FINAL broods of the year, here seen capping their cells with silk, will emerge before frost kills off the workers. These final wasps of the season will all be queens and males



▲ HERE IS PORTRAYED the completion of the cycle as the queens and males emerge from their cells (photograph inverted). These insects now pair, and the males die soon afterward. The fertilized queens crawl into safe hiding places for the winter, to emerge in spring and start new colonies single-handed again, as shown in the first picture

ANTARCTIC NURSERY



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

THE ice that covers the bays and inlets of Antarctica is the nursery for the baby Weddell seals. Early in the southern spring, the first part of October, the females come up on the ice. For about a week before their babies are born they spend most of the time lying about and sleeping. The young seals are large at birth, half their mother's length or more and about 75 pounds in weight. The mother stays with her baby the first week, then goes into the water to catch fish. The young ones grow rapidly; by the time they are ready to be weaned, after about eight weeks, they weigh about 300 pounds. The mother seal loses just about that much weight during this time.

The baby seals enter the water when they are only a little over a week old. At first they swim with their mother in the shallow pools on the bay ice. Mother and young play and roll about in the water. Sometimes the mother supports the young seal, sometimes she pulls it under and if her baby does not want to go in, she may catch it by the neck and pull it in.

The young seals are pale gray, lighter below and faintly mottled, while the adults are shiny, dark iron gray above, streaked and spotted with yellowish white below. From nose to tail a large one stretches nine and a half feet and may weigh nearly a thousand pounds. Their heads are relatively small and so are their flippers. All year around the Weddell seals live in the bays where the ice is permanent. They feed on fish of various sorts, chasing them under the ice. They must be successful at this, for during the winter the seals get extremely fat.

ON YOUR RADIO

Programs of the American Museum of Natural History for February, 1945

WEDNESDAYS over WNYC and WNYC—FM

from 3:30 to 3:45 P.M.
Science for the Seven Million

Conducted jointly by Lucy Clausen and Julius Postal

Feb. 7—*Science in the News*
Feb. 14—*Romantic Animals*
Feb. 21—*Early American Scientists*
Feb. 28—*Thawing Out*

THURSDAYS over WNYC and WNYC—FM

from 8:15 to 8:30 P.M.
Science for Freedom

Conducted by Julius Postal

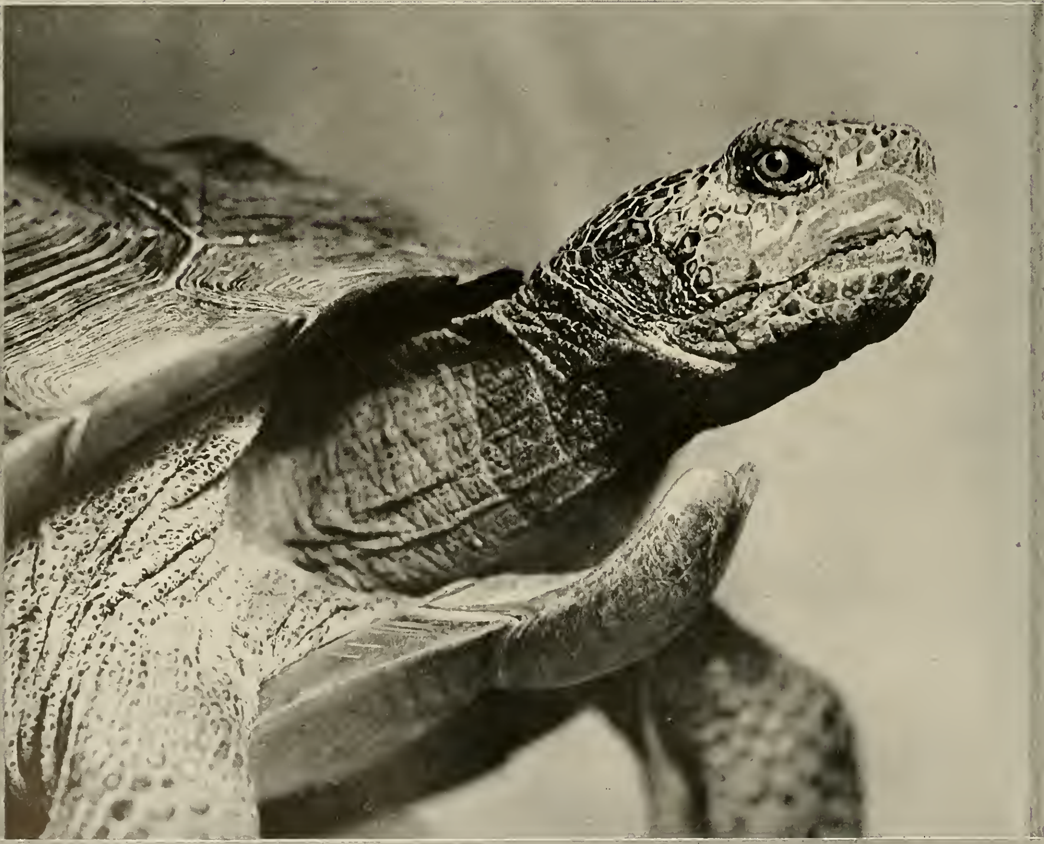
This program presents answers to questions covering a wide range of topics in natural science.

Although they have to breathe like we do they stay in the water under the ice all winter; it is decidedly warmer here than on top of the ice, with the storms and bitter wind. Killer whales, the chief enemy of the seal family, can not go far under the ice: although they resemble fish more than seals do, they cannot breathe under ice. The seals get air even though the ice may be eight feet thick. As the cold increases, ice contracts and cracks with noises like cannon shots. The seals come up in these cracks and chew through the ice that forms over them. Their strong, peglike teeth project forward. Weddell seals use these teeth like a drill, twisting and swinging the head, with the mouth wide open, and they rasp through several inches of ice in a short time. The snow forms deep drifts over the blowholes and hides them, but seals can be heard frequently throughout the winter.

NATURE THROUGH THE CAMERA'S EYE

By RICHARD L. CASSELL

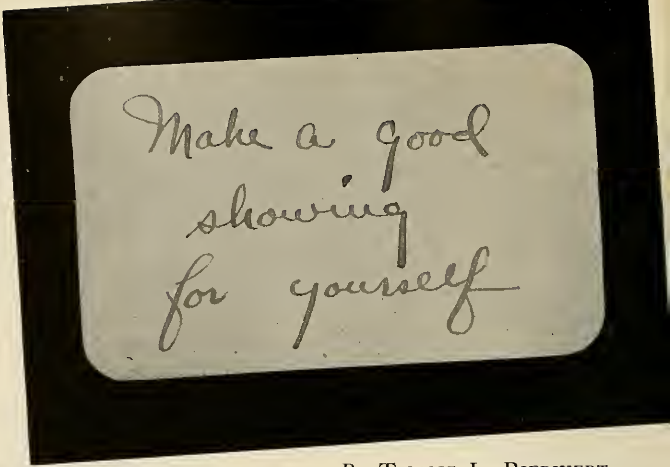
▾ A DESERT TORTOISE: *Gopherus agassizii*



➤ PORTRAIT OF
A BARN OWL

◂ HORNED TOAD:

Phrynosoma cornutum



Make a good showing for yourself

By THANE L. BIERWERT

Acting Chief, Division of Photography, The American Museum of Natural History

THE great pleasure of Kodachrome photography is viewing the results. Nothing is more beautiful than a well-exposed, nicely composed, sparkling color transparency. You see more in the slide than you ever saw in the real subject.

Often you invite friends to enjoy your slides with you. Naturally you are thrilled at seeing the woodland scenes, close-ups of flowers, various vacation shots, and the rest of your collection "blown up" on the screen. After the show, the guests may turn and say, "Great stuff, Old Man. Certainly must make you feel good to have a group of pictures like that. Well, must be running along now—hard day tomorrow."

To show color slides properly entails honest-to-goodness work. There is plenty of drudgery, repetitious at that, but well worth the effort, because your friends will say, "That fellow really knows how to put on good entertainment. If he ever invites you over some evening, by all means go."

The spectator is interested only in the result, but in order to produce a show (and that is exactly what you are doing) everything must be organized. The slides must be arranged, and a script or outline prepared. Projector, screen, and seats must be properly placed, and you must know where the house lights are located. During the first few performances, you may become tangled in the cables or seat Aunt Esther of the high hair-do directly in front of the projector, but that is one way to learn.

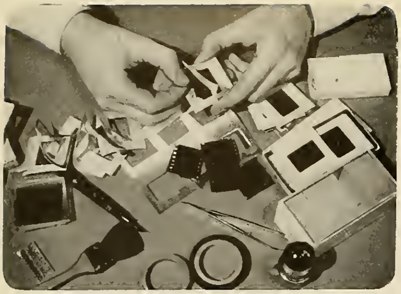
The first step is to select the pictures. Before you do any trial projecting, exclude those that are over- or under-exposed and those with poor composition. The ones that are left should be thrown on the screeen and further reduced in number.

The good pictures should be mounted between glass. Why not leave them in the cardboard mounts? Good slides deserve protection from finger marks, atmospheric changes, and heat buckling. It is easy to clean glass but very difficult to clean the delicate surface of color film.

Work out an assembly line method for the work of mounting. Lay out as many masks as you have slides to mount and write on each the title, location, date, and catalogue number, if you have that many slides. Remove the film from the cardboard mounting, peeling it apart along the edge opposite the fold. In cleaning the cover-glasses, use one of the window cleaning preparations; this is easier and quicker than using hot water and soap. Sandwich the films between the cover-glasses, being careful to brush off the inside surfaces to remove lint and dust. Cut several lengths of tape eight and one-half inches long, laying them parallel on the table, and then start binding. Don't forget to paste a star or other adhesive marker at the lower left-hand corner to show where the thumb grasps the slide in putting it into the projector.

This is a pleasant pastime for those long evenings, and winter is an excellent season for it because the air is dry. Slides mounted in humid weather cloud over when heated up in the projector.

An assortment of mountings—plain cardboard, glass with cardboard, glass with standard mask, and metal bindings—require individual focusing. Some fit snugly, others jump around in the carrier. Uniform mounting will make the performance run smoothly from start to finish.

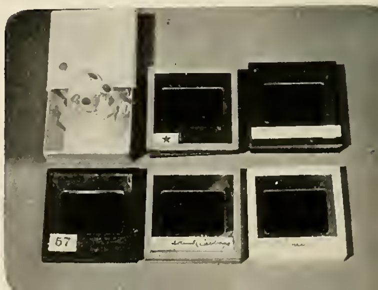


▲ MOUNT your best Kodachromes between glass for protection and to ensure uniform focus in the projector. To remove the film from its original cardboard, peel the mounting apart along the edge opposite the fold

▲ AFTER RECORDING the title, location, date, and number of the photograph on the paper mask, sandwich the film between carefully cleaned cover-glasses. Bind the mounting with an 8½-inch length of tape

BEFORE PRESSING the tape firmly in place, cut the corners with a razor (*above*) or snip them off with scissors (*below*). This is to make them lie flat

▼ SEVERAL WAYS of labeling the slides on the c
side are shown here. The star or dot indicates p
tion of thumb in inserting the slide in the projec
The number also establishes sequence. These lab
can be changed without taking slides apart



Now comes the important task of arranging the sequence. First group all similar slides in separate piles and plan your show. If the story is about a trip you made, follow a chronological order. Arrange a selection of slides to illustrate a typical day of your adventures photographing wild life. Or, project a series showing changes in autumn foliage that you recorded the past fall. Never, under any circumstances, blindly project box after box of slides regardless of subject. Have an interesting and appropriate explanation for each slide. Experience with the reaction of your audience will help you to build up toward dramatic effects.

In all probability most of your shows will be for the family and for interested friends. Arrange your theater before your guests arrive. When you go to the movies, you don't find the workman still hanging the screen. For small audiences a screen with a smooth, white, matte surface is preferable because at close range a beaded screen throws back a glare. Place the screen slightly above the eye level of your audience and seat them about halfway between the screen and the projector, because this position most nearly duplicates the camera position and angle.

As soon as the first picture is on the screen, check your focus and speak your piece. Never hurry on to the next slide, but don't linger too long either. Allow your audience enough time to take in the contents of the picture, depending upon its importance in your story. When you change to the next slide, take about one second to make the transition; scientific experiments have determined this as the best interval. Do not zip your slides across the screen or you will have a headache-y audience wishing for the end of a jumpy show. And be sure your projector is anchored so that the picture is rock-steady on the screen.

Who knows but that you may have the makings of an Elmendorff, a Stoddard, or a Burton Holmes. After you have organized a few first class family shows you will find that they are in great demand by the local Women's club, Boy Scout troop, or Masonic Lodge.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

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MINIATURE ANIMALS

A new exhibit of the unique collection of miniature animal sculptures modeled by Louis Paul Jonas, taxidermist and artist, will remain open to the public at the American Museum of Natural History until February 18. Each model is one-tenth life size and scientifically accurate in every anatomical detail.

Mr. Jonas has created his sculptures in characteristic attitudes of the living animals. A zebra guarding her young colt, a pair of bull moose locking horns in battle, white sheep leaping rocky crags, and a baby kangaroo looking out at the world from his mother's pouch are only a few of more than 100 lifelike miniatures.

Mr. Jonas' work as a taxidermist and sculptor of full-size animals is represented in many United States museums, and with this knowledge of animal anatomy he began, some ten years ago, to reproduce in scale miniatures the outstanding wild life of the world. What started as an interesting workshop hobby soon became a full-time job. Children's museums of natural history, schools, colleges, universities, and institutions for the blind use them as "three dimensional pictures" in the study of natural history, in miniature habitat groups, and in more highly specialized exhibits on comparative anatomy.

After study of anatomical records, action photos, and motion pictures of an animal, Mr. Jonas works an average of two weeks on the original sculpture in clay. A plaster mold is then cast from the clay sculpture, and plastic is forced into the mold by compressed air. When the plastic hardens the mold is removed and the miniature is painted in the distinctive coloring and markings of the animal. Horns and tails, being of latex, are unbreakable.

Mr. Jonas' studio is undoubtedly the most unusual in the world—an old, abandoned railroad station in Mahopac, New York. The former waiting room now serves as the modeling studio, and his office occupies the ticket-agent's compartment.

The exhibit was arranged under the direction of Miss Katharine Beneker.

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LETTERS

Continued from page 49

the air, but after going a little way, the goose fell away from him and dropped to the ground. I then rode over to where the goose lay and found him practically dead. I would judge that the goose weighed at least five or six pounds.

R. O. Bliss.

San Francisco, Calif.

* * *

Correction

The Indian rock shelter depicted in a model on page 462 of the December 1944 issue of Natural History was unfortunately described as being located near Armonk, New York. The rock shelter shown was actually found near the northern end of Manhattan Island, in Inwood Park.—Ed.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

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SCIENTIFIC SPECIMENS FROM THE WAR ZONE

Many Americans in service in the South Pacific become interested in the strange or highly colored fishes of those waters. Frequent letters come to the American Museum describing or asking for information about them, and occasionally a few specimens are forwarded to add to our collections. The most interesting such addition so far received is a shipment of fresh-water fishes from New Guinea, which reached us some five weeks after being mailed by Lt. Otis Barton, U.S.N.R.

Fresh-water fishes cannot cross the sea, and Australia and New Guinea

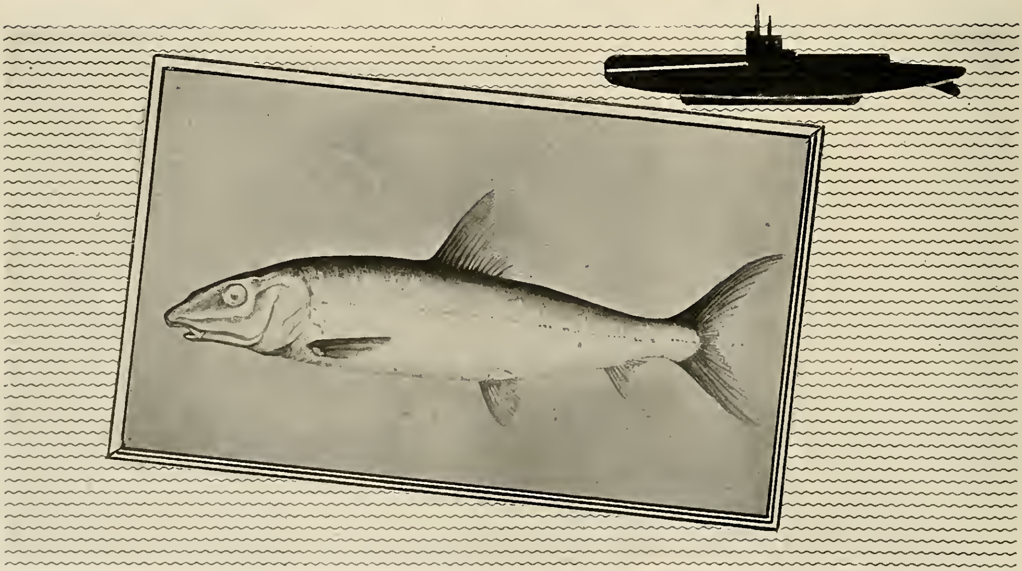
MUSEUM FISH PORTRAITS ADORN SUBMARINES

Seventy-three famous American men and women are honored by inclusion in the Hall of Fame, but more than twice that number of fishes have been given individual underwater art galleries. These are the fishes after which submarines in the United States Navy are named.

Some months ago the American Museum of Natural History was asked to assist in providing authentic fish portraits for new submarines. To date, the artists of the Museum's Illustrators' Corps have contributed between 70 and 100 scientifically accurate paintings. As many more have been done by staff artists employed by the ship yards; and the American Museum's Department of Fishes has been instrumental in providing much of the necessary information.

How many fishes have been honored in this way is the Navy's secret. The one photographed here just before being sent to sea is the Macabi. But many of the "totemic" fishes will have to content themselves for the present with the admiring glances of their own crews.

The Macabi, namesake of a submarine: one of the many fish portraits provided by the American Museum for undersea craft



have been separated so long from the continent of Asia, that continental fresh-water fishes such as the carp family, abundant enough in the East Indies, do not occur there. There are, however, numerous small fresh-water species, representative of marine families such as the cardinal fishes (Apogonidae) and of *Melanotaenia* and related genera, singular little fishes which are probably derived from the marine silversides (Atherinidae).

Lieutenant Barton writes that these fishes were collected in rather shallow water of a deeper lake with dynamite, and describes going to the lake to collect them as follows:

> "It was all clear from camp, a valley clad in tropical forest, on the bottom of which a fair-size stream cascaded among crystalline boulders. Farther down the forest thinned out, and the stream meandered into a lake. I figured that I could walk to it in two hours, but it actually was to take four.
>
> "At first I scrambled down a steep forest-clad bank. Footprints and rootings of wild hogs were apparent in the mud. I soon connected with a tributary stream and climbed down a rocky stairway along its bed. A flock of butterflies were sunning themselves on a boulder. Their markings were browns, grays, and whites; none of the giant blues were here.
>
> "The tributary led to the main stream, where I had a refreshing swim, and proceeded. . . .
>
> "Further on my way I saw a pair of strange birds slowly patrolling the edge of the jungle from the air. To me they seemed to have the beaks of hornbills and the trailing legs of herons. Down on the flatter country a massive form hopped away through the cover. Far downstream I met four bronze-black natives. They had been digging for something in the stream bed,—maybe gold. They took a great fancy to my wrist watch. Fingering it, they remarked 'Ticketon, ticketon.' I felt a little apprehensive, but then thought of beckoning upstream and waving to an imaginary escort. Soon I was well past the natives."

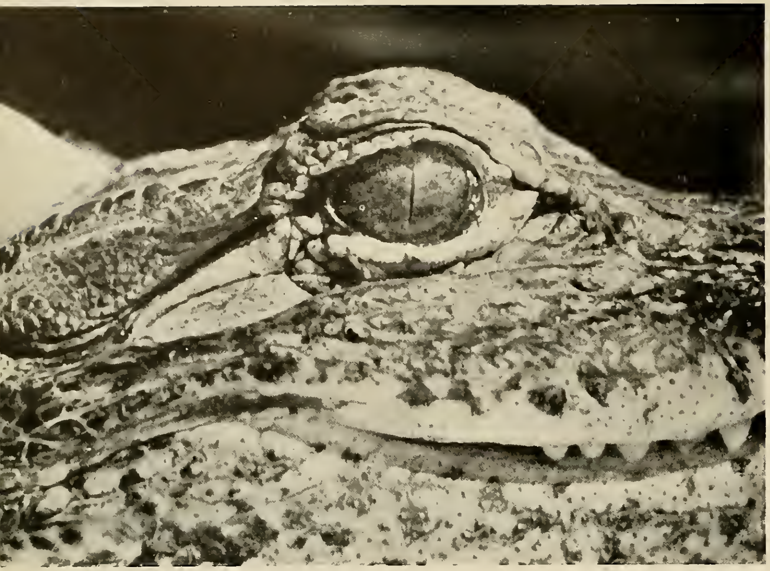
Censorship does not permit Lieutenant Barton to mention the specific locality where he secured the fishes he sent us. Among the specimens, a goby and two or three individuals belonging to the Melanotaeniinae still retained their bright colors as in life, and a sketch has been made of them for permanent record, as fishes lose color in preservative.

Lieutenant Barton hopes to study the specimens he is sending after the war.

J. T. N.

▲ NATIVES of Netherlands New Guinea in an outrigger canoe: a scene from the region in which Lt. Otis Barton collected the fish described in the accompanying note

▼ NAVY MEN inspecting a Moorish Idol, a peculiar widely distributed tropical Pacific fish. Its arrival at the American Museum is expected in another shipment of scientific specimens collected by Lt. Barton, on duty



▲ THE ALLIGATOR'S EAR is so well hidden by a flap of skin that many persons familiar with the animal do not know where it is located

Where are the 'Gator's ears?

SIRS:

"The Saga of Oscar the Musical 'Gator" in which Dr. Frank A. Beach described the reactions of a captive alligator to various sounds (NATURAL HISTORY, December, 1944) prompts me to submit the enclosed photographs. During the past summer I spent a month, with Dr. Edwin H. Colbert and C. M. Bogert of your scientific staff, at the Archbold Biological Station in Florida. We were studying the effects of heat on alligators and therefore were not particularly concerned with their hearing. However, during the course of our work we discovered that virtually no one, including experienced hunters, knew where the 'gator's ear was located even though hunters often resort to grunting in order to draw these large crocodilians from cover.

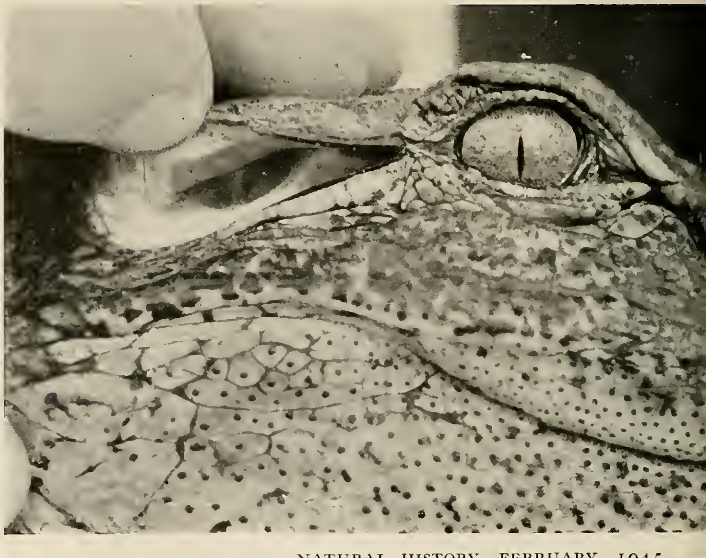
As may be seen in the photograph, the ear is situated behind the eye and rather high on the head so that it is not submerged when the alligator lies on the surface. The relatively enormous tympanic membrane or "ear drum" is securely hidden by a flap of skin that serves as a valve. When the reptile goes beneath the water the muscular flap tightly closes, presumably excluding water. But when the 'gator comes out of the water the muscles relax and a slit is apparent. Doctor Colbert noted that immediately after coming to the surface, 'gators sometimes vibrate these flaps, apparently to shake off any water that remains on them. When the flap is lifted with the thumb, as can be seen in the photograph, the tympanic membrane is readily apparent, and even the cartilaginous connection leading from it to the stapes is dimly visible through the transparent tissue.

Presumably the sunken position and the flap provide the protection necessary for such a large tympanic membrane. Its size is possibly associated with more acute hearing than that found in most other reptiles. 'Gators evidently hear both under water and on the surface. During our stay in Florida we heard accounts of 'gators that had learned to respond to calls. While visiting the Caloosahatchie Canal the Lockmaster, Mr. Fred Flanders, provided a demonstration. For several months he had been feeding a five-foot 'gator from his boat landing. Although he had already fed it the day we arrived, he went to the edge of the landing and called "Toby!" a few times. Within a few seconds the reptile came up from the depths and rested on the surface until Mr. Flanders threw it a slice of bread, scarcely its normal food. However, it swam forward a foot or so, seized the bread, and then dived. A short time later it came to the surface several feet away, still holding the bread in its mouth.

Alligators are indeed among the more interesting reptiles, and we were pleased to learn that the State of Florida is taking serious measures to protect them. Perhaps Doctor Beach's excellent article will stimulate even more interest in these relicts of a bygone era.

RAYMOND B. COWLES,
Department of Zoology,
University of California,
Los Angeles, California.

▼ BUT WHEN THE FLAP is raised, the 'gator is seen to have a large ear drum, which may help to explain the creature's acute hearing



March NATURAL HISTORY 1945

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LETTERS

SIRS:

. . . All five of us in my home and many of our friends enjoy the NATURAL HISTORY. It is one of the few magazines whose old copies we keep and treasure and refer back to from year to year.

This past year we have especially enjoyed the articles on the voyage of the "Askoy," partly because of the excellent way they are written and partly because some of the phenomena described have counterparts in Hawaii. We, too, have our wet and dry coasts. With us, too, the sea will show different colors where the depth, temperature, or other conditions vary. Off our eastern and southern shores we have seen areas something like Dr. Murphy's "dancing waters" and smooth slicks over which the sea birds hover.

The "dancing waters" as viewed from cliffs on shore appear as small areas of normal water that have been roughened with a giant file, or as if some huge sea monster were playing just below the surface and distorting the normal shoreward set of the waves.

The cause here is purported to be the inpouring of large quantities of subterranean fresh water through outlets along the steep submerged cliffs close to shore. Because of the height of our mountains and the heavy rainfall, this fresh water is said to come out with considerable force and, being lighter in weight than the salt, to rise and disturb the normal currents along shore. However, I have never been able to reconcile this explanaton with the relative coldness of the fresh water, the heavy undertow that exists all along this coast, and the lack of pressure in the water in wells bored not far inland.

No explanation has ever been given me for the slicks, nor why they should seem to contain more life than surrounding areas of ocean. No explanation has been given either of the long slow swells which sometimes pile in irregular "tides" at times when the seismographs indicate no earthquakes.

If the true explanation for these is known and can pass the censor, may we have it in some not too distant issue of your magazine? If it is not known, then I think it would be fine if the "Askoy" and her staff would study Hawaiian waters more thoroughly after peace comes again.

HELEN S. BALDWIN.

Hilo, Hawaii

* * *

The following answers to the questions in Helen S. Baldwin's letter are offered by Dr. Robert Cushman Murphy, who also expresses his appreciation for her gracious remarks about his articles on the Askoy Expedition:

Two of the correspondent's questions are, fortunately, rather closely related, because they concern the pressure or weight of water and air respectively.

Hawaii has, indeed, extremely strong contrasts between wet and dry coasts, the rainfall on certain islands being of world's-record proportions on the windward side but almost negligible to leeward. Yet I am confident that the true explanation of the "dancing water" seen offshore has nothing to do with *subterranean* water pouring into the sea. It is certain that the bulk of rapidly running fresh water on the islands is carried in *surface* streams, and that most of the water underground flows downhill only by a process of seepage.

"Dancing water" may be caused by friction of several kinds, one of which results from wind whipping the surface against a tidal or other current. It may also be produced along the borders of two surface currents having different directions and densities. The latter word, which is equivalent to weight, refers to different temperatures or different salt content in the two masses of water. A third cause may be "upwelling" from a layer of deeper ocean water through a surface layer of different density. Such phenomena are possible because the ocean is made up of stable and stratified layers which, owing to their different densities, do not mix readily. Due to rapid evaporation and cooling at the surface, the relative weights of superimposed layers sometimes get out of balance or become inverted. This may result in a more or less violent overturn, of which "dancing water" becomes the visible expression.

Slicks on the ocean are usually to be attributed to living organisms. Sometimes the excreta of fish, porpoises, or whales make a microscopically thin film over a considerable area of surface. Also, the mere presence of a very large school of fish, or even of smaller creatures, has the physical effect of disrupting wave action. The resulting smoothness of the surface, when contrasted with surrounding rough water, sometimes resembles an oily slick.

The long, slow swells are related neither to local winds nor to earthquakes, but represent what are known as "barometric waves." They usually come from a distance and often pile up as enormous breakers on continental or island coasts. It is difficult to think of air as a heavy substance, and yet its weight on the surface of the ocean amounts normally to about 14 pounds per square inch. When the barometer falls, the air weighs less, and when it rises, the air weighs more. Rapid changes in atmospheric pressure therefore cause depressions or rebounds of the surface of the ocean, and these are sufficient to produce swells that travel very rapidly for hundreds or thousands of miles.

Casablanca, where our troops first landed in Africa, is a famous place for barometric swells that have their origin in middle latitudes of the North Atlantic. Before the war a regular meteorological service existed for the purpose of predicting the "surf days" on the African coast,

Continued on page 140

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President — Albert E. Parr, Director

VOLUME LIV—No. 3 ★ ★ ★ ★ **MARCH, 1945**

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You will find Natural History Magazin indexed in *Reader's Guide to Periodical Literature* in your library

THE CANADA GOOSE on this month's cover was photographed by Henry B. Kane, whose outstanding work is familiar to readers of Natural History. This Kodachrome not only shows this fine goose to good advantage but also illustrates some of the hazards of nature photography. To quote Mr. Kane, "The shrub growing up beside the nest looks like a dead alder, at casual glance. So did lots of others sticking out of adjacent hummocks. I pulled the boat through by grasping them firmly, and held the boat still by wrapping an arm about one. Too late, I discovered they were poison sumac!"

The Canada Goose is well known as a harbinger of spring, and nature lovers in North America eagerly await the first sight (or sound) of the V-shaped flocks powerfully winging their way northward. There is no surer sign that winter is on the way out. These geese formerly nested much more widely than at present, for the opening and draining of new lands have driven many water birds to more restricted areas in the north where they may still find conditions to their liking and where they have a chance to survive and rear their young. There are some portions of the northern United States where the Canada Goose may still nest sparingly—a shadow, only, of the former vast flocks that made their summer homes in that region and even farther south.

The nest is built on land or in shallowly watered terrain, sometimes on muskrat houses or on hummocks like those shown in this photograph. It is lined with down and may contain from four to six creamy or greenish white eggs, rarely as many as twelve. Twenty-eight or thirty days are required for incubation.

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YOUR NEW BOOKS

SOUTHWEST PACIFIC BIRDS • HONEY • WOLVES
LATIN AMERICA • ANTHROPOLOGY OF KODIAK ISLAND

BIRDS OF THE SOUTHWEST PACIFIC

---------- by Ernst Mayr
Preface by Robert Cushman Murphy
Color Plates by Francis Lee Jaques and Line Drawings by Alexander Seidel

The Macmillan Company, $3.75
3 color plates, 16 figures, 316 pages

OPPORTUNITY and the man did a model job when they joined hands to produce this volume. To two and a half years of field exploration the author has added a sufficient period of laboratory research in the American Museum to handle fully the details of relationships and distribution in a manner designed effectively to assist others. For the first time, therefore, we have in a single small authoritative volume a key to the birds of the Southwest Pacific. More definitely, the territory covered includes Samoa and the Phoenix Islands on the east, westward to the Solomons, and northwestward to the Marianas, an area of continental dimensions.

Dr. Mayr's skill and experience in assembling data have assisted him in presenting his facts without needless duplication and with economy of space. Wide-ranging species, like sea birds and the largely migratory shore birds, are treated respectively in Sections I and II. The Land and Fresh-water Birds are grouped systematically in Section III and geographically in Section IV. The book, therefore, serves both as a general, as well as special guide. It tells us of birds as well as of the bird life of the islands or groups whose avifauna is more or less local or insular. This arrangement should be of much assistance to the student. Dr. Mayr emphasizes the comparatively limited amount of material he has had to work with and urges others to help fill the many gaps in our recorded knowledge of the range and habits of Southwest Pacific birds, and he gives an outline to guide us in our studies.

Three well occupied color plates, by F. L. Jaques, and about a dozen line drawings by Alexander Seidel introduce us to 50-odd species of birds that we may not have met before and thereby help in our identifications. The author dedicates this attractive book to his wife.

FRANK M. CHAPMAN.

THE SCIENCE OF MAN IN THE WORLD CRISIS

--------- by Ralph Linton

Columbia University Press, $4.00
532 pages

THIS book was planned to reveal anthropology as a contributor to the solution of world problems. Of its 21 chapters, 10 were written by anthropologists, 5 by sociologists, and 6 by specialists in an equal number of other academic fields. Without exception the anthropological authors are optimistic; the pessimists are to be found chiefly among the sociologists. Obviously the contributors were handpicked, but not all groups of research problems pursued by anthropologists are considered, the topics being somewhat arbitrarily selected. In the main, the foci of discussion are the concepts of race and minorities. Numerous slogans and warnings are sounded, as, pleas for more study of human biology to prevent world collapse; defense of the thesis that all races are born equally intelligent and of equal competence; that studies of personality will save the world; that understanding the processes of culture change and man's capacity to learn will point the way to eternal peace; that the natural resources of the world will maintain man for thousands of years, though there is danger in over-population; that the Indian problems in North and South Americas are on their way to solution; that the greatest threat to the peace of the world lies in colonial possessions, masses of "color," hotbeds of race prejudice ready to explode, etc.

If there is agreement among these 21 contributors, it is that humanity desires individual freedom, unselfish toleration, and a blind faith in the slogan that "man can make himself after any social pattern he chooses." Not all do more than hope that this is the last war and that national aspirations can be curbed. Though the anthropologists are sure that their science can save the world, no one of them has ventured to outline a plan of action to achieve the desired ends; their plea is for more and more research in anthropology. We suspect the general reader may find the chapters more or less difficult, since a good grounding in anthropology is presupposed.

NATURE ENCYCLOPEDIA

Edited by G. Clyde Fisher; five volumes bound in De Luxe Green Keratol lettered in Gilt, pages are 5⅜ x 8 inches. Lives and habits of Birds, Mammals, Fish, Reptiles, Flowers and Trees; described by renowned Naturalists; 700 illustrations, 200 in Natural color. The Literary Mart, 8 East 33rd St., New York 16, offers this set for $7.50, remittance with order, returnable for full refund within five days.

If the statements of the anthropological contributors are truly representative, they seem to imply that there is no such reality as human species behavior. Psychologists and biologists, however, usually assume the reality of "original behavior" as an important part of the environment to which culture, or human group life, must adjust itself to realize security and the "fuller life."

C. W.

WILDWOOD WISDOM

------- by Ellsworth Jaeger

The Macmillan Company, $2.95
469 illus., 474 pages

INDIANS are always most ingenious in making tools from the things they have. Before the advent of the white man they lived off the country, successfully hunted the wild game, fished the waterways, made boats and all the equipment necessary to live a healthy life in reasonable comfort and ease. They read the trackless waste and unraveled its mystery to the early explorers and adventurers. To the friendly Indian of the past we owe our knowledge of American woodlore.

Ellsworth Jaeger is one of the few who gathered his information firsthand and spent many summers with the Indians in the United States and Canada. His activities brought him in contact with such leaders of the great out-of-doors as Ernest Thompson Seton, Dan Beard, John Burroughs, and Kermit Roosevelt. *Wildwood Wisdom* is not just another book to read but a veritable encyclopedia of woodlore, gleaned from years of experience and research. It is a book for the experienced woodsman as well as for the vacationist who plans a trip for the first time to the trackless wilds. Mr. Jaeger describes and illustrates with countless drawings all the essential requirements for the camper.

The first part of the book covers primitive and modern equipment such as clothing, shelters, beds, fire and firewood, the use of the ax and knife, and a very clear description of camp cooking with illustrations of edible, poisonous, and useful plants and trees. The second section is devoted to the crafts and skills acquired as by-products of camp life. There are chapters on barkcraft, canoes, trail blazing, animal calls, primitive tools and weapons, wildwood medicines, camp furniture; also winter life in the woods, including toboggans, dog sleds, and harnesses. Also included are diagrams showing how to make all these intricate things, and patterns showing how to make clothing from skins.

Wildwood Wisdom is written in simple direct language that will afford hours of pleasant reading by the fireside. It contains 474 pages of text, 193 plates of nearly a dozen illustrations each, a complete index, list of contents by chapters, and an alphabetical list of illustrations.

Mr. Jaeger is a skilled craftsman as well as an author and lecturer. His ambition has been to popularize nature study, and he has done this by every means available to him.

GEORGE G. GOODWIN.

THE WOLVES OF NORTH AMERICA

- - - - - by Young and Goldman

The American Wildlife Institute, $6.00
131 plates, 15 text figures, 636 pages

THIS book of 636 pages is an exhaustive report upon the history, life habits, economic status, and control of wolves, as well as the scientific classification of these animals. The authors are senior biologists in the Fish and Wildlife Service and have had wide experience with their topics.

Stanley P. Young, in Part I, presents a well-documented account under many headings. Full descriptions of the habits and characteristics are given and are usually illustrated by field observations. The wolf has been very widely distributed, but the range has been materially reduced in historical times. Certain natural checks, parasites, and diseases control the numbers of wolves, but through conflict with human interests man has become the dominant factor in the reduction of the wolf population.

A reader familiar with the problems of Federal mammal control and the criticism it has evoked from the conservationists will scan the writings of Mr. Young with particular interest. Such a reader will be encouraged by the following statement in the Introduction: "In the more remote parts of North America, especially in Alaska, northern Canada, and on the other extreme, even in Mexico, suitable habitats remain where these large killers can exist in no direct conflict with man. No reason is, therefore, apparent to us why they should not always be tolerated, and even accorded a permanent place in the fauna of the continent; rigid control, however, must be maintained where their presence clashes with human welfare."

Major Goldman's classification of the wolves, in Part II, is a systematic review. A revision of the North American wolves has long been needed, and it would appear that Goldman's work has brought order where formerly there was chaos. He catalogues all but three of our wolves under 23 subspecies or geographical races of a circumpolar species, *Canis lupus*, the name given by Linnaeus to the Old World animal. For three wolves found in Florida, Louisiana, and Texas, Goldman uses *Canis niger* and its subspecies. Between the wolves of the *lupus* group and those of the *niger* group, there are rather significant differences, such as smaller size and more slender proportions, as well as distinctive cranial features.

Wolves interbreed freely; they seldom encounter a physical barrier to their geographical distribution, and anyone studying the map of the 23 subspecies of *Canis lupus* might be pardoned if he wondered whether there were actually this many identifiable races. Goldman believes all of these do intergrade but states that the distinguishing features are maintained with a fair degree of consistency over areas often of considerable extent. If he is able to correlate his material and pigeonhole specimens from a given region, then he has satisfied the criteria for a subspecies. However, I suspect that a person with one or two specimens from uncertain localities might have difficulty fitting them into the proper pigeonhole.

H. E. ANTHONY.

HONEY AND YOUR HEALTH

- - - - - - by Bodog F. Beck and Dorée Smedley

Robert M. McBride & Co., $3.00
12 plates, 10 figures, 246 pages

FIRST published in 1938, by the late Dr. Beck, this successful book has now been revised and enlarged by Dorée Smedley. Far from being solely an invaluable eye-opener on the enormous value of honey as a health food, the authors have compiled a far-reaching, extremely noteworthy history of the honeybee and beekeeping as practiced by ancient and modern apiarists.

Among the Anglo-Saxons, honeybees supplied the king and nation with an important food, also the famous honey drink, and wax candles. But the most fertile field in which bees played a paramount part in social, economic, and spiritual life of the ancient, lay in Egypt. German archives tell of Charlemagne's domesticating wild bees in Nuremberg forests out of gratitude because, after being stung, he recovered from obstinate gout. The Nuremberg forests were the bee-garden of the Holy Roman Empire, and under Charles IV, the bee-garden of Germany.

India, China, Greece, France, the Island of Corsica, Hungary, Austria, and Slavic countries, all show early records of the part "man's best little friend" played in the production of honey: drink, light, and medicine. History states that honeybees were non-existent in two regions, Australia and the Americas, and were there imported. In the seventeenth century, honeybees were brought to America by English, Spanish, and Dutch settlers. In the nineteenth century honeybees were introduced into California. Today, the best honey producing areas in the United States are New York, Pennsylvania, Ohio, Indiana, Michigan, Wisconsin, Minnesota, and mountain areas of the West, and territory within 100 miles of Los Angeles, California. Florida is known for its Tupelo and Orange blossom honey.

Today, as of old, beekeepers may be either fixtures or nomadic. Ancient apiarists placed hives on boats and drifted along the Nile; today in United States, apiarists place hives on trucks, following the sun and blossoms to Florida and then North again to greet the summer.

ELIZABETH LINN.

THE ANTHROPOLOGY OF KODIAK ISLAND

- - - - - - - - - - by Aleš Hrdlička

The Wistar Institute of Anatomy and Biology, $5.00
228 illustrations, 486 pages

KODIAK ISLAND lies along the southeastern base of the Alaskan Peninsula. Together these two land areas form a connecting link between the mainland and the thin line of Aleutian Islands that reach out toward Asia. Any wave of migrants seeking an American landfall via the Aleutian causeway would, therefore, be likely to reach Kodiak and in all probability leave some evidence of their passage. Moreover, any coastal migration moving down from the Bering Sea region might be expected to touch Kodiak on its southward course. For these reasons, the archaeology of southwestern Alaska, including Kodiak Island, has always held out the promise of harboring the evidence from which a reconstruction of the settlement of the New World might be achieved.

Dr. Hrdlička began his investigation of the Alaskan area in 1926 and for ten seasons thereafter until 1938 he spent his summers, assisted by students, digging for the remains of the folk who had inhabited those regions in the past. Five seasons were put into excavating a settlement at Uyak Bay, Kodiak Island. Acres of soil were peeled off and 2,000 years of occupation were uncovered. Two principal occupations of the site were established. The first one continued for 12 to 15 centuries and is named "Pre-Koniag" by Hrdlička. These pre-Koniag people were physically quite different from their successors, and Hrdlička is inclined to associate them with Indians, in particular with the Algonquin of the eastern United States. Their culture was of relatively high artistic merit.

The Koniags who followed the earlier Indian-like inhabitants possessed a simpler and cruder culture. Physically they seem to represent an intermixture of an Aleut strain with the Indian stock of Southern Alaska. The natives found in residence when Kodiak was discovered were representatives of the Koniag occupation.

The conclusion arrived at by Dr. Hrdlička that the earlier inhabitants of Kodiak were basically Indian fits nicely the hypothesis of an Indian origin for certain strains of Eskimo, which other students have set up to explain insistent similarities.

This opus will be gratefully received by all students of native America, who

Continued on page 142

Tantalite—
a Cinderella among Strategic Minerals

When expert mineralogists were hurriedly sent far and wide to search for one of the less conspicuous elements, the secrets of its important role in the war effort were so closely guarded that even they did not know exactly how the mineral was to be used

A.M.N.H. photo

▲ AN UNUSUALLY PERFECT FOUR-POUND CRYSTAL of tantalite

By FREDERICK H. POUGH*

Curator of Physical Geology and Mineralogy
The American Museum of Natural History

SOME of the minerals that are considered of strategic importance now that we are at war are old ones whose value has long been recognized, such as the ores of mercury, tin, and nickel. Others are Cinderellas, which have been touched by a magic wand only since the war began. The need for these has far outstripped anything imagined a few years ago. Quartz, with its general use in radio communications, is one such substance. Tantalum, a relatively rare and very heavy metal, is another. As with quartz, we have had to turn to other nations for our supplies; and Brazil has turned out to be one of the most important sources of both these minerals.

Tantalum is an inert, heavy, light bluish-gray metal, unaffected by most acids. It melts only at 2900° C. and is as hard as steel. Its uses are dictated by these properties. Its name is derived from that given the ore tantalite (from the Greek *Tantalus*), because it was "tantalizingly" difficult to make into a solution for analysis.

▼ JOSE MARCELINO DE OLIVEIRA, owner of the Alto do Giz, weighing $6000-a-ton tantalite, one of the heaviest minerals

Photo from Coordinator of Inter-American Affairs

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*DR. POUGH's mineralogical activities have been partially traced in previous articles in NATURAL HISTORY. In 1933, -35, and -37 he traveled in Europe, visiting mines and mineral localities. He has recently made two trips to Mexico to observe the new volcano, Paricutin, and procured the most spectacular photographs that have been taken of its eruption. During the past year he has twice visited Brazil on mineral surveys, incidentally collecting the most notable mineral specimens that have been added to the American Museum's collection in some years. These include a new mineral of gem quality, which he named brazilianite in honor of the country.

Nature photography, particularly with flowers, is an active hobby with Dr. Pough, and he lectures on native orchids, gems, and volcanoes. He has studied at Washington University (St. Louis), Harvard, and Heidelberg.—ED.

Before the war, tantalite received scant regard, and production was small. Gradually, as experience with the metal increased, more and more uses have been found for it. Some were extensions of older uses in which tantalum performs a service better than another metal; others are new ones, resulting from the creation of new compounds that demanded a substance with properties possessed by tantalum. Pipe linings and containers made of tantalum are used for corrosive chemicals used in wartime manufacturing. Radio transmitter tubes with grids and anodes of tantalum are of great importance in the small portable radios of the armed forces. Tantalum carbide is a constituent of practically all cemented carbide cutting tools. Perhaps most important of all its uses is in surgery, for tantalum has been found to be the ideal metal to take the place of shattered bone; flesh clings to it as to no other artificial substance. Today, when so much surgery of this type is necessary, tantalum is in great demand, and for many months it was the newest and most important strategic metal of World War II.

Tantalum may be derived from many different minerals, though one alone fills most of the ore sacks shipped to the Fansteel Metallurgical Corporation, sole processor under the government regulations in force today. This is tantalite, a well-known oxide mineral. It has been mined occasionally for years as opportunity afforded but was utilized principally for the other metal that it contains in varying proportions—columbium, also called niobium. As the proportion of columbium rises in this isomorphous mixture, the name of the mineral changes and it becomes columbite.

Columbium oxide is far lighter than tantalum oxide, so that measurement of the specific gravity of a piece gives a reasonably accurate determination of the relative proportions of the two oxides. A specific gravity of 7.2 means that there is 70% of tantalum oxide and 30% columbium oxide. At 6.5, each is present in equal amounts, and only the seller of tantalite knows what to call it. For him tantalite goes down to 35%, the lowest grade used for the extraction of tantalum today. To the mineral collector, anything with over 50% niobium oxide is properly called columbite.

The way in which the rocks containing columbite and tantalite were formed fortunately caused them to be

Frederick H. Pough photo

▲ TANTALITE is found in "dikes," tabular bodies that were injected while molten into fissures in the earth's crust. When weather and running water lower the surrounding land, the dikes are left standing, sometimes like walls. This is the Urubu (or Buzzard) Mine, showing typical workings and dump on the top of the hill. The level Borborema peneplain is seen in the foreground

Frederick H. Pough photo

▲ A TYPICAL WALL-LIKE PEGMATITE DIKE, with dumps around its base from prospecting attempts. Tantalite mining is highly speculative. This locality proved too poor to work. Carnauba, Rio Grande do Norte

▼ THE Boquerão Mine, on a hilltop above Parelhas, a typical *alto*, or hill, and one of the most productive in the area

Frederick H. Pough photo

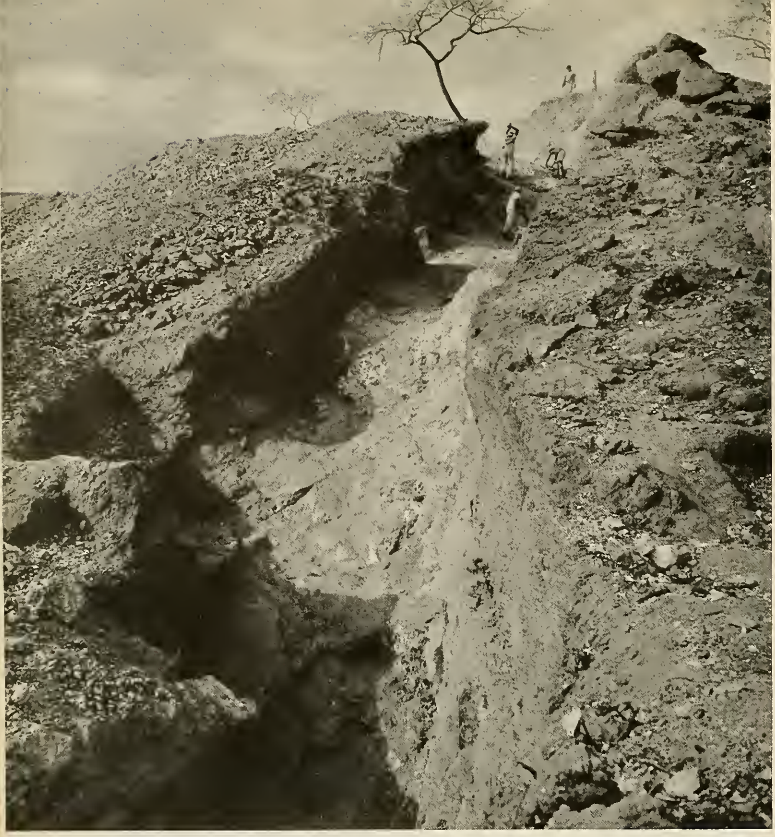


Photo from Coordinator of Inter-American Affairs

▲ THE ALTO MAMOES, one of the longest of the dikes, over half a mile in length, and now proving to be one of the richest

localized in a rather conspicuous type of geological formation. They are found in coarsely crystallized granitic "dikes." These are tabular bodies that were injected while molten into fissures; and here in northern Brazil subsequent erosion of the surrounding terrain frequently leaves them standing like walls. The molten rock of which they are formed was the last of a larger mass to remain fluid. The first portions that crystallized used only the common elements, like iron, aluminum, sodium, calcium, magnesium, silicon, and oxygen. All of the rare elements remained to be deposited in the dikes—beryllium, caesium, lithium, uranium, tantalum, and columbium,—along with volatiles, like water, carbon dioxide, and fluorine. Thus the dikes contain interesting minerals built up from the molecules of these uncommon elements, scattered through a coarse matrix of large crystals of quartz, feldspar, and mica. The rocks of which the dikes are formed are known technically as pegmatites, and the rare minerals contained in them are said to belong to the pegmatite assemblage.

The northern states of Brazil—Ceará, Rio Grande do Norte, and Paraiba—reveal some of the world's finest pegmatite dikes. Only where ancient parts of the earth's crust contain large masses of granitic rock that have been exposed through ages of erosion do we find pegmatites. And the molten mass must have been insulated and thus prevented from cooling all at once. The ancient crystalline shield that forms eastern Brazil from Ceará to São Paulo provides just such conditions. It is an ancient highland that has been elevated above sea level for many geologic periods and now almost entirely bared of the sediments that covered it for brief intervals. So we find there a wonderful exposure of crystalline igneous rocks marking the top of an ancient batholith.

When too much of the overlying material is worn away, the dikes are worn away along with the upper layers of granite and the low places in the batholithic roof. But in the northern Brazilian states we have almost ideal conditions. Erosion has progressed just to the top of the batholith, and many roof pendants of the ancient sediments persist in the lower places of the originally undulating ceiling of the upward sloping granitic intrusion. Pegmatites are not the only economic deposits in the region. Tungsten ore, fluorite veins, and rutile deposits are a few of the related phenomena so well revealed here.

Geological conditions and agents of erosion have made the area an especially propitious country for geological work and economic exploitation, while climate has joined to make it a mineralogist's paradise. Even though but a few degrees north of the equator, high country and almost desert conditions make the temperature and humidity bearable at all times, and there is little vegetation to obscure the outcrops of the interesting formations.

The high plateau, with a base elevation around 1800 feet, is marked by many hills caused by variation in the resistance of the rocky foundation to erosion. Through the best of fortune, the pegmatites seem to be the most resistant formations, with the result that they occupy peaks of eminences or stand like walls of ancient masonry cutting across the countryside. Prospecting is easy; mining is simplified. In a country where timber is almost unobtainable and underground mining a difficult task, what could be more ideal than to find deposits that can best be worked as open cuts or simply washed from the gravels flanking the sharply rising dikes? There are difficulties in pegmatite mining, however, which will be discussed later.

There are two types of dikes in this region, and they are not unlike pegmatites the world over. The commonest, by far, are the simple, or, as they are called in Brazil, the homogeneous pegmatites, which are mineralogically monotonous and economically worthless. They are usually smaller than the valuable dikes and are composed of a mixture of the common granite minerals, quartz, feldspar, and mica, with perhaps a little black tourmaline or garnet. They are narrower than the complex, or inhomogeneous, dikes and resemble prehistoric walls in their numerous outcrops.

The complex pegmatites are rarer, though usually larger, and they are by no means scarce. Unfortunately only a few are rich enough in valuable minerals to repay the work of mining them. Prospecting is simple. The slopes below the outcrops are tested to see if they contain any of the heavy mineral, tantalite, which is the chief object of mining in this area. Should there be found an alluvial concentration where it has been washed down from the decomposing pegmatite, the *garimpeiros* consider it indicative of the possibilities from the still intact dike. A high yield of tantalite gravel will warrant an exploration by quarry methods, but mining of a pegmatite is probably one of the greatest gambles a mining man can undertake. Many pegmatites are sampled, but very few repay the work and cost and time by giving up the heavy mineral in quantities to pay the workers and give the owner a profit, even though high grade ore sells at $6000 a ton.

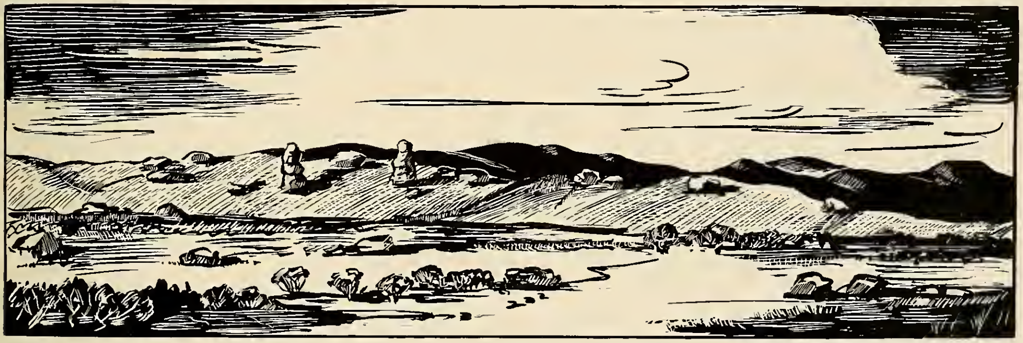
The mining of a pegmatite is unlike ordinary vein mining, and the experienced engineers who have been sent there by the American government to assist the Brazilians in getting the maximum possible production in a limited time all swear that when they have finished the job they will never again have anything to do with pegmatite mining. The reason for this is that in vein mining there is always a definite lead to follow. The vein may grow thicker or thinner, richer or poorer, but at least every day sees some production.

In pegmatite mining there is also a definite vein to follow, but work may proceed for days, weeks, or months without seeing anything worth recovering.

When they do hit ore they may get a rich mass, as in the Alto Taboa, which not long ago produced three tons of $6000-a-ton ore in a single mass. This particular mine has been a consistent producer and has yielded other pods with two or three tons. But between these rich strikes they go for days without seeing a speck of black in the rock. At the prices, they can afford the barren work, but few mines are so successful. Three thousand tons of rock are removed for each ton of recoverable tantalite, and the operator about to give up never knows but that the next blast will produce enough to keep him going for half a year.

It is not surprising that the visiting geologist rarely sees any of the mineral. Tantalite's value is so great that no trace is left standing in the mine after a discovery. All ore is immediately cleaned out and shipped, usually the same day. There are few places in the world where one can visit mines day after day and never see any ore, though the mines are operating all the while and many of them paying well.

Other pegmatite minerals are associated with tantalite, some of which, like microcline feldspar, spodumene, and lepidolite, would also bring a good return in another country. But here, where there is no near-by consumer and transportation is so difficult, the minerals must accumulate in the dump. Only the beryl, for which about $150 a ton was being paid when



Drawings by Museum Illustrators' Corps

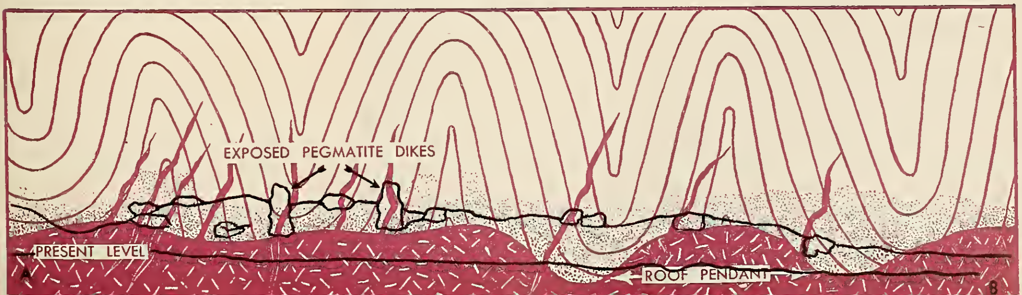
▲ **Pegmatite dikes** standing up like walls and bastions on the eroded peneplain of Borborema in Rio Grande do Norte

▼ **HOW PEGMATITE DIKES ARE FORMED**

The dark area represents a mass of once-molten rock. The projections thrusting upward from it are dikes in the making. They are highly fluid portions of the larger mass, charged with rare and sometimes valuable minerals. Pressure from below has forced them up through cracks in the partly solidified mass, into the folded layers overlying it. There they cool and harden. In the stippled band immediately above the dark area, the folded rocks have been altered by heat and gases.

Long ages of weathering and erosion wear away most of the overlying material. The dikes are thus left projecting above the surface of the ground, where prospectors can explore and sample them for useful minerals, among which tantalite is today one of the most important.

In this drawing the present level of the ground would run roughly from A to B, depending on the extent to which the overlying material had been removed by erosion.



Frederick H. Pough photos

▲ As MINERS excavated the material from the staked-out leases in the Malhada de Angicos tungsten mine, the original boundaries were preserved by rope markers stretched across the old surface. Several thousand workers rushed to this mine in a few months

▲ SHOWING how the barren quartz core (*right*) is avoided in pegmatite mining, which follows the ore-bearing areas on each side. This is the Alto do Giz, source of simpsonite and one of the oldest mines in the region

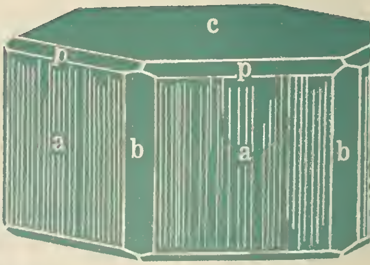
buying stopped, and a little mica, are salable. The production of beryl was many times that of tantalite, and it served as a nice profit-maker for a mine that did not pay well enough in tantalite alone. Some operators claimed that they were losing money on both and that they could maintain tantalite production only by tying in ten tons of profitable tungsten ore (scheelite) with each ton of tantalite. The scheelite represents one of the most interesting new developments of the northern mining area. It is mined from metamorphosed impure limestone beds of the residual roof pendants.

Native mining methods in the northern country are primitive in the extreme. Labor is drawn from the cotton farms in the region, and the population is surprisingly large for a land that seems so barren. There is also stock raising, and in parts of Ceará the wax of the carnauba palm is gathered.

The cotton is of the finest quality, with a long fiber that separates easily from a smooth seed. One planting about every 15 years suffices. The plant would grow into a small tree if allowed to, but it is kept to shrub size by pruning. The maximum yield is from the fifth to the fifteenth years, and the plant may live as long as 20. Interspersed with the cotton one often sees the spineless *Opuntia* cactus, developed for regions like this where cattle feed is hard to find.

Tropical Brazil is frequently pictured as a steaming jungle with heavy rainfall, but in this section lack of

A.M.N.H. photo



▲ A TYPICAL SIMPSONITE CRYSTAL, from the first known source of measurable crystals of this rare mineral, at Alto do Giz, Brazil

◀ AN EXTRAORDINARY two-inch crystal of simpsonite from Brazil: a rare mineral first discovered in Australia in 1939 and named for E. S. Simpson, Government mineralogist of Western Australia water is the chief problem. The rainy season comes in January and February, but some years it fails to materialize at all. Attempts have been made in some places to drill artesian wells, but little water has been encountered. An ambitious federal department, the *Inspectoria Federal de Obras Contra as Seccos*, is planning to build dams and develop large irrigation projects as funds permit, and in the few that have been completed, some of the finest gardens and rural homes anywhere in Brazil are seen. Eventually there will be many more people living in the area, with a far higher standard of living than the average there today.

The water shortage makes working the alluvial deposits a real problem. Water is carried in on donkey back and used over and over again in operating the primitive washers. A washer is seen in the photograph. Ore-bearing gravel is placed in the middle box, and water poured in the upper. A paddle works back and forth, giving the effect of a jig. The light material floats over the top of the paddle, and the heavy mineral piles up on the floor of the box, from which it is periodically removed. Most of the tantalite recovered in this way is in small fragments. The alluvial beryl, most of which has decomposed anyway, is lost.

Frederick H. Pough photo

➤ LOOKING DOWN UPON Parelhas, a typical small town and local center of mining in the dry interior of northeastern Brazil. In the foreground are beautifully tinted outcrops of rose quartz

After the alluvial portion of the dike has been worked over, mining may commence on the part still intact. Weathering has been very deep in this region, and in many cases the "alto," or hill, has been preserved by the resistance of a solid quartz core, a characteristic of many of these almost vertical dikes. Along the outer walls, there is usually a mixture of moderately coarse-grained feldspar (now often turned to clay), coarse-grained quartz, and a dark mineral, tourmaline or mica. A foot or so in from the outer edge we find a greater separation of the constituents. The quartz and the feldspar crystals have become much larger, and with them are the valuable minerals. This band may be six or eight feet thick, sometimes more; and it frequently abuts against a barren core of solid white or rosy quartz which may be as much as 20 feet thick. Then the succession, in our ideal pegmatite, may begin again and continue to the farther wall, making a dike 50 or 75 feet through. These pegmatites are longer than those we know in many other areas. The Alto Mamoes, for instance is over half a mile long. Most North American pegmatites are measured in terms of a few hundred yards.

The primitive mining methods result in the dumping of refuse without regard to future operations and the creation of dangerous working conditions by digging under overhangs. But the United States Government

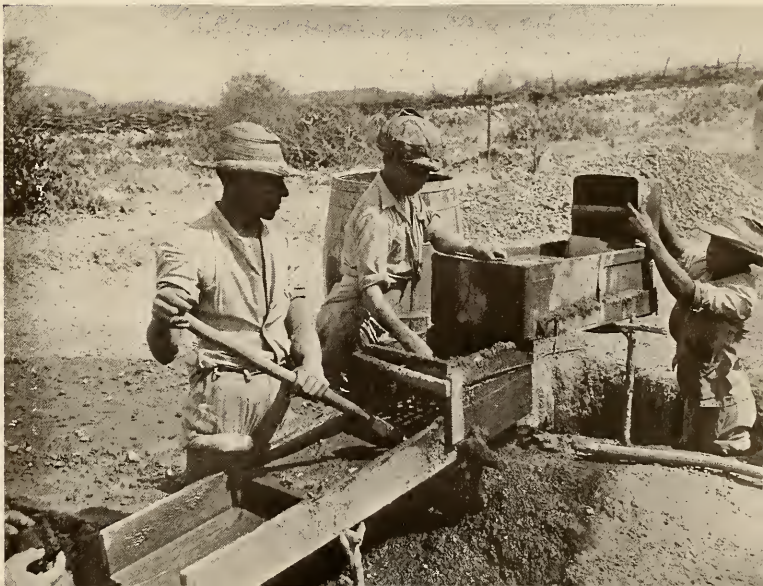


Photo from Coordinator of Inter-American Affairs

➤ A PRIMITIVE JIG for separating out tantalite. Water is poured in at the top and washed down through the ore. The material is worked back and forth so that the lighter dirt floats out over the paddle and the heavier concentrate is left in the bottom. In this arid region, the precious though muddy water is used over and over has attempted with great success to increase production by supplying technical advice on the soundest methods of operation. Machinery has been supplied, money lent for payrolls, and roads built so that the ore can be more conveniently shipped out and machinery brought in. Tantalite production increased several hundred per cent during the two years that this program has been in operation.

Experience has shown that the pods of tantalite are most likely to occur near the margin of the quartz core and in the coarsely crystalline altered feldspar. Although the feldspar in some of these deposits is largely altered to clay there is still enough hard quartz and fresh feldspar left to make the work difficult and to involve considerable blasting. The greatest physical contribution of the North Americans to this work came in the form of air compressors for drilling the holes for blasting. These greatly increased the speed with which a stretch of dike could be opened up.

Beryl and tantalite are carefully picked out by hand and promptly carried to the hut that serves as mine office. Beryl may be piled up outside, but the tantalite is stored in locked chests. When enough has been accumulated, it is shipped off to the nearest buyer, who may pay $2.50 to $5.00 a kilo (2.2 lbs.) for it, depending upon the value that experience has shown him should be put on the ore from a particular mine. This ore, purchased from many little producers, is periodically shipped to the railhead and export center, Campina Grande in Paraiba. There it is reworked by careful crushing and washing in gently sloping conical pans, after which it is sacked and shipped to the United States. Over 90% is said to pass through the hands of Silveira Dantes of the Silveira Brazil Company, the principal producer.

Beryl, too, is reworked at Campina Grande, because feldspar, quartz, and tourmaline are often intergrown with it, sometimes inside the very crystals. The beryl is broken up by a hammer into fist-size chunks, sacked, labeled, and shipped in the same way as the tantalite. The tungsten ore comes in almost as a sand, but it, too, is usually reprocessed by the same simple hand methods and sacked for shipment.

The refractory nature of the compounds of tantalum make them mineralogical problems that the chemist is loath to tackle, and the relative rarity of the ores has meant that few samples have been available for study. One would think that with the present production, many fine specimens would have been collected, but this phase of the work has regrettably been neglected. Most of the men, both the Brazilians and the North American engineers, are little informed in mineralogy and have not appreciated the importance of collecting typical samples and all unusual varieties in as large, unbroken pieces as possible. Hence, a fine opportunity has largely been lost, and only an occasional specimen has been spared by some discerning engineer or buyer who took the trouble to keep it intact. Still fewer specimens have got into the hands of competent mineralogists, who would appreciate their importance and save them until happier world conditions might permit a detailed study of the Brazilian ores. For tantalite is not the only Brazilian tantalum mineral; there are many others.

The most interesting is probably simpsonite, a little-known and poorly described hexagonal aluminum tantalate, first found in Australia in inconspicuous, partly altered crystals. A strongly kaolinized dike known as the Alto do Giz, in Rio Grande do Norte, has produced the finest crystals of this mineral ever seen, better even than those from a second source recently discovered in Africa. The sharp, fresh looking, six-sided crystals of the Alto do Giz are yellow-brown in color and well developed. Unfortunately, none were saved in aggregates; perhaps, indeed, none were found this way. However, fine loose crystals were found in several places and will serve for crystallographic work.

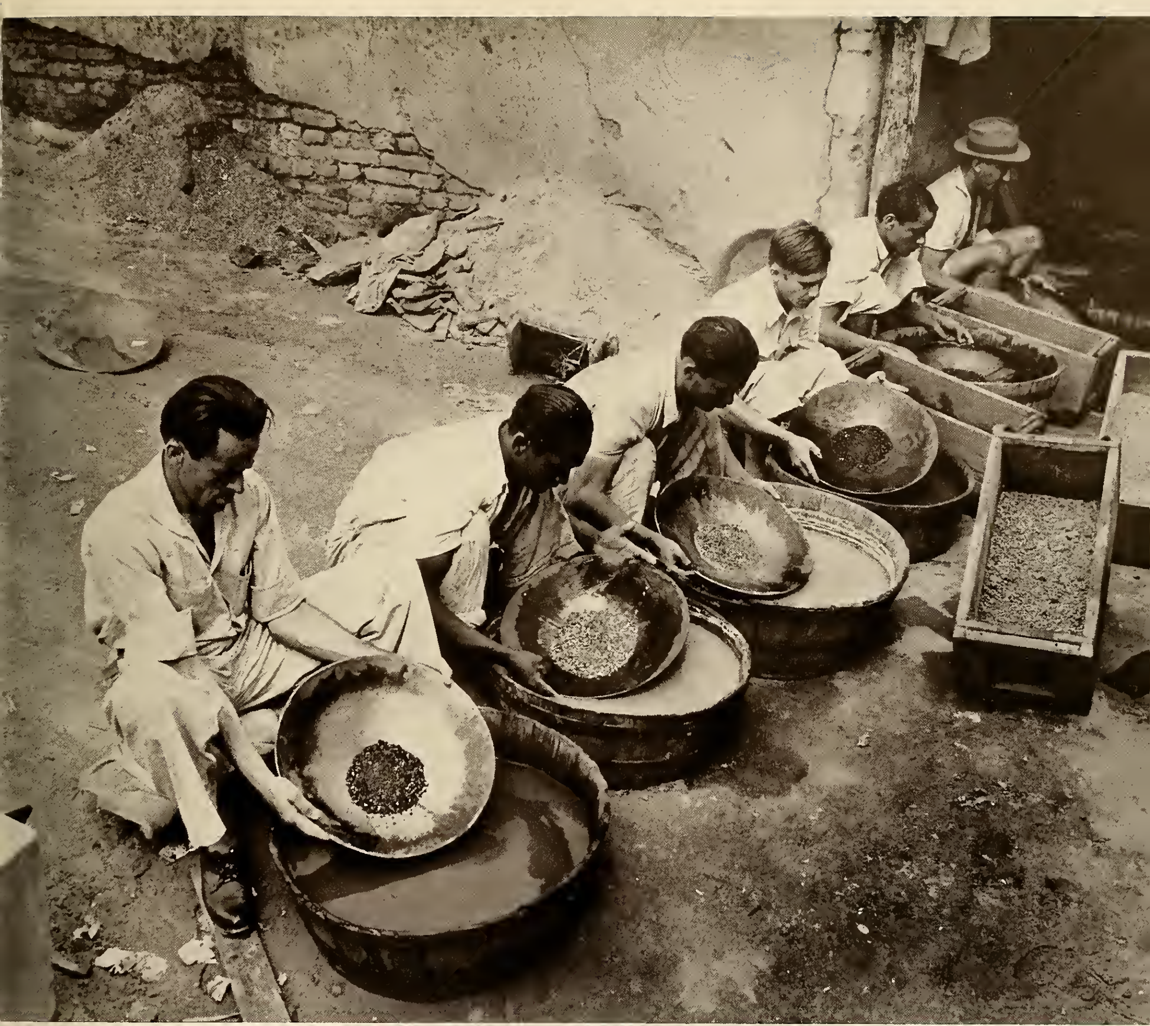
A few broken fragments of a heavy white mineral were seen in the town of Equador at the office of the owner of this mine, Jose Marcelino de Oliveira, and X-ray examination has shown that this white mineral, too, is simpsonite. Before they were broken, they must have been of considerable size, several inches across. Associated with the brown simpsonite crystals are many tiny green octahedra which proved to be microlite, a calcium tantalum oxide and one of the commonest of the tantalum minerals.

Columbite occurs at this mine, in black orthorhombic crystals, and there are also some small but sharp reddish-brown crystals of what seems to be manganotantalite, a manganiferous variety of the commoner, usually black mineral. Large crystals of manganotantalite were seen from many mines, most notable from the neighboring Alto Mamoes and the Varzea de Vassoeira. A very rich and interesting mine not far away across the hills, but many miles by road, is Onça Mine, where a rare black tantalum mineral tapiolite, is veined by white streaks of an alteration product, for it is changing to microlite. Simpsonite is said to have been found at this mine, too, and the crystalline masses coming from there show other crystal faces from those of the Alto do Giz and look quite different.

However, it will be some time before all these interesting minerals can be studied, and at the end of November purchases of the too expensive tantalum were stopped because considerable stock-piles had been built up in this country and because African and Australian production had increased.

During my journeys in the region, travel in the desert states was greatly facilitated by the work of the United States Commercial Company, a branch of the FEA; and the houses maintained by the staff of their engineers made a pleasure of what would otherwise have been arduous and uncomfortable work. I am greatly indebted to the division engineers E. H. Page and his successor James E. Moore for their help during my studies in the area.

The secret of much of Brazil's production of strategic minerals lies in the fussy, painstaking, and time consuming work that is performed by poorly paid laborers, whose standard of living is far below the North American scale. Even now, poor as the wage scale is, much of the tantalite is produced at a very low profit. Clearly the mines could not be worked if wages were much increased, without a great rise in tantalite prices. Perhaps one should expect to pay more for this valuable metal. Certainly anyone who has seen the poverty of the miners and the terrible gamble the operators take feels that tantalum is one of the valuable substances of this earth, hard to find and hard to work, and surely worth more than the higher prized but more abundant metals like silver and gold.

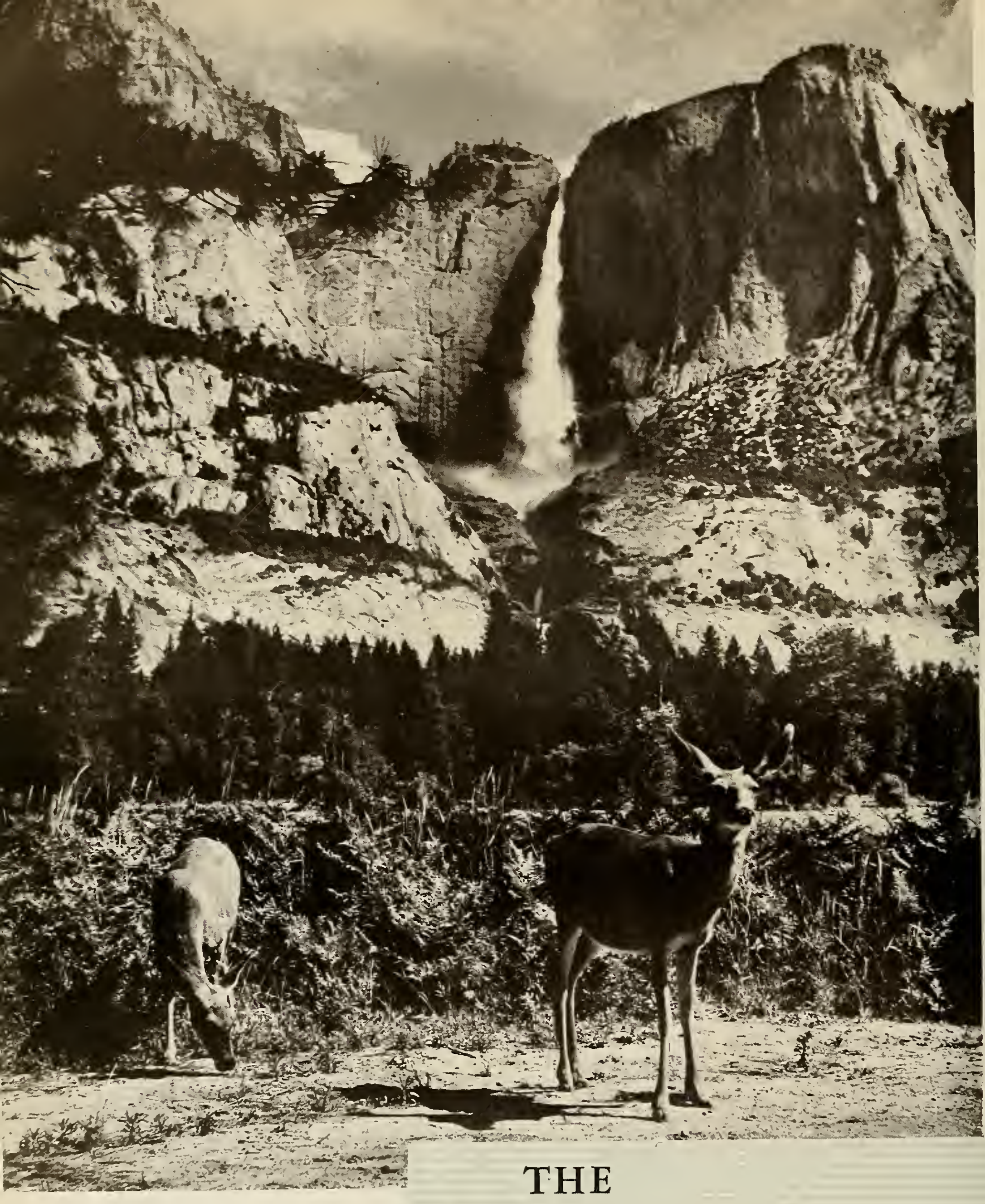


▲ **Reworking** tantalite and tungsten ore by hand-washing at Campina Grande. All the ore is reworked thus before being sacked for shipment

Photo from Coordinator of Inter-American Affairs

Frederick H. Pough photo

➤ **These fine grains** of tantalite are the result of rewashing tons of fragments from the old dump. Disappointments are many, but the lure to prospect new dikes is strong, for the discovery of a rich "pod" sometimes repays months of barren work

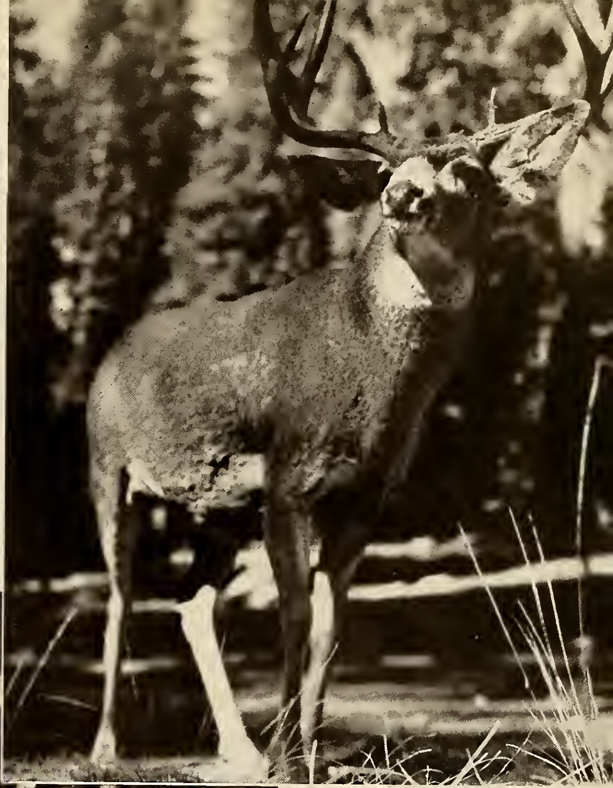


▲ THE YOSEMITE FALLS provide the background for this scene, but California mule deer are apt to be seen in many places along the western slopes of the Sierra where timber or brush offers concealment. They are called mule deer because of their long ears. The upper surface of the tail has a black line and white edging, and is longer than that in coastal black-tailed deer

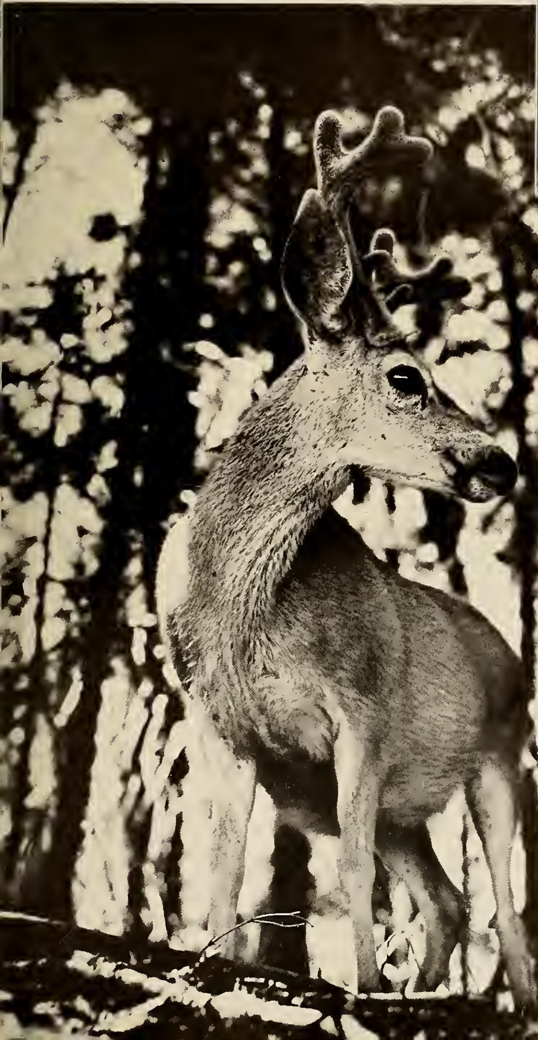
THE *California* Mule Deer

By Joyce and Josef Muench

➤ All the strength and alertness that are typical of the California mule deer are found in the posture of this grand old buck of the mountains. When startled, the animal launches himself into the air with all four feet, as though propelled by steel springs, clearing bushes and low trees as he bounds off in rapid flight



⮟ A young buck caught by the camera in his native woodland. Summer finds his antlers still in the velvet. This covering of thin skin and soft hair will be shed with the coming of fall and the mating season. Early in spring the hardened antlers will be shed



◄ THE GENTLE EXPRESSION in the eyes of the mule deer gives little indication of the powerful, explosive action of which the animal is capable

◄ DURING the mating season (October to December) the male collects as large a harem as his strength permits. After that he leaves the does and joins the other bucks, usually in lower ranges where food is plentiful. They do most of their feeding early in the morning and late in the evening, or even by moonlight

A toad is like *THIS*

By

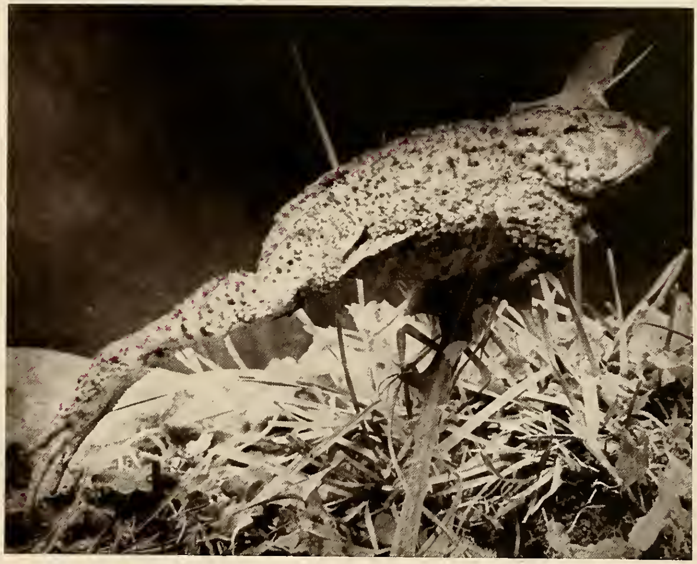
Roy L. Abbott

Iowa State Teachers College

Photos by

Henry B. Kane

Strange things happen when the little defenseless tadpole forsakes its slimy pond for a life on land as a complex and effective organism



1 In the middle of a hop: a toad leaping. Note that the fast camera caught the animal with its eyes shut

In the dampness and dense shade of the great rhubarb leaf, the toad sat half-buried, her brown, warty skin blending imperceptibly with the crumbly soil. Now and then some big black ants hurried across her broad back, but except when one chanced to pass an inch or so in front of her head, she gave them no attention, for the sun was yet high, and although she couldn't resist snapping up any small fry that came within range of her quick tongue, she would not set out on any active hunting until sundown.

Not that the toad wasn't hungry. Except when hibernating, she was always hungry, and now particularly so, for she had just returned from a two-weeks' pilgrimage to a near-by pond where she had deposited her first eggs—some five or six thousand jelly-covered, shot-sized things left there to hatch and shift for themselves as best they might.

The toad had spent nearly all of her four years in this garden, and, save for the long journey just completed, had never once left it. The egg-laying trip was a new experience, a response to new urges, such as the high, shrill voices of male toads calling from the pond, and the quiet but equally insistent pressure of the many eggs in her body—the voices, as it were, of potential toads clamoring to be born.

The toad herself had begun life in this same pond. But now, squat, pop-eyed, four-legged, and nearly as large as a man's fist, she looked little like the chuckleheaded fishy mite who, along with several thousand others, had wriggled free from the gelatinous, rosary-like egg-strings left there by her mother.

In fact, at that early age, the toad was really a fish, for she breathed air from the water through delicate, feathery gills on each side of her head, and propelled herself by means of a broad tailfin. But, strangely enough, she was a fish who couldn't eat, for her mouth had not yet broken through into her intestine, and until that necessary thing occurred some six days later, there was little for her to do except to cling to some water weeds by means of a pair of head suckers, or to make short, wriggling journeys from one plant to another. But when her broad-lipped mouth with its two rows of teeth above and three below finally appeared, she and the rest set out with ravenous appetites to make up for lost time, scraping the tiny green plants from their supports, biting off fragile, tasty bits from the ends of larger ones, and even sucking in minute animals from the ooze at the bottom or the slime at the top. If a dead fish or a worm was found, she joined the hungry crowd about it, shouldering the rest aside and holding her place at the feast by sheer muscular power until sated.

As a result of all this food-taking she had grown mightily. By the end

2 NOTHING MOVING, NOTHING EATEN. The toad strikes only at a moving object

of six weeks she was an inch-long tadpole, black in color with a fine stippling of gold, and breathing now by internal gills instead of the external ones, which had disappeared.

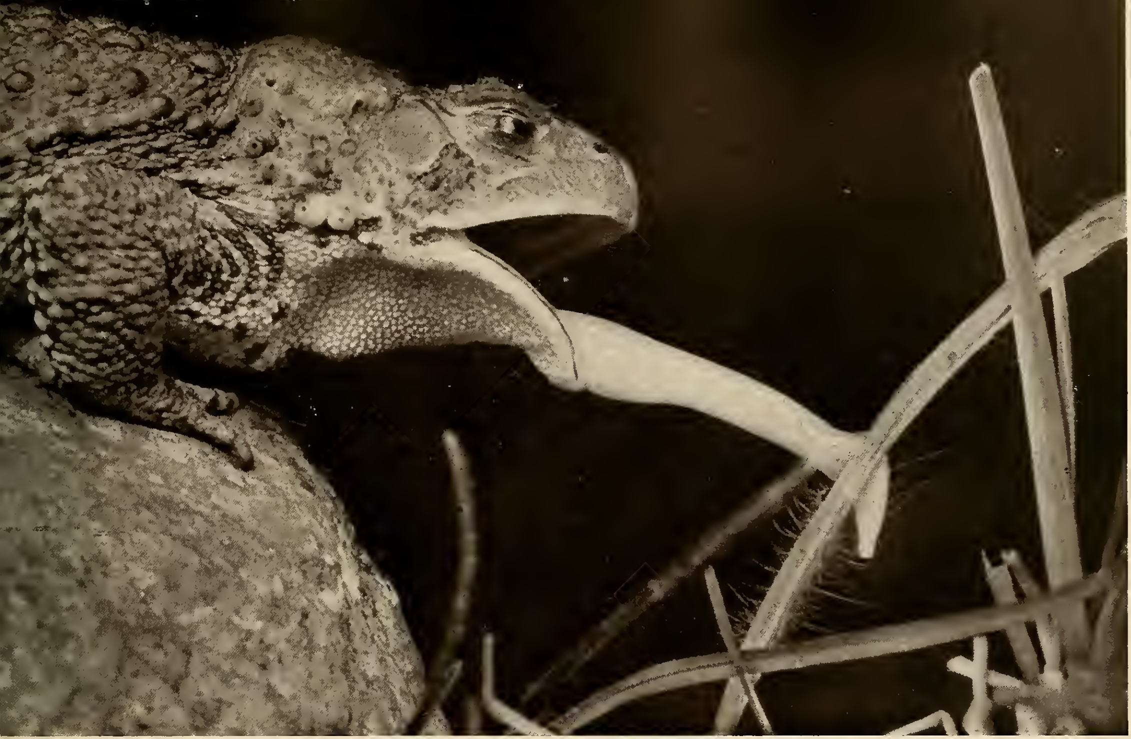
And at this juncture, strange things began to happen to her. Upon each side where her tail joined the body, rounded buds of flesh protruded themselves and grew steadily backwards—the beginnings of her hind legs. Soon joints appeared in these stumps, then toes and feet, and she then began using her newly formed legs along with her tail in swimming. Meanwhile, internal changes were also occurring. Her long intestine, coiled like a watch spring, began to shorten. And from the front end of her food tube two saclike growths appeared and pushed backward. These were lungs. They were to fit her for land life, and since her internal gills had already begun to fail, she was even then using these new organs, gulping them full of air at every trip to the surface.

Seemingly, she was to have no front legs. But two weeks after the formation of the hind ones, the front pair appeared suddenly. Quite ready for use, they broke through the gill coverings which had concealed their development, and now for the first time, the embryonic toad really looked like a toad. For even before her front legs appeared, her head had changed greatly. Her tiny mouth had been replaced by a huge one, its wide opening extending far back under her eyes, which in turn had become large and elevated and covered with lids, and which appeared bright and beautiful as a toad's eyes should.

But for all these transformations she was still a rather strange creature—a toad well enough, but a toad with a long fishlike tail. Nature soon disposed of this incongruity, however, by allowing her to resorb the tail and use its materials for other purposes. So, freed at last from all semblance of a fish, she was now a complete toad in all respects except warts; they were to come later.

With the loss of her tail, the toad left her pond, with her several thousand brothers and sisters. That is, with those who had come to real toadhood. For although the sticky, jelly covering had protected the eggs well enough for most of them to hatch, the tadpoles had been less fortunate. Once outside the protective jelly, a host of predators had assailed them. Hundreds perished in the masked jaws of ferocious dragonfly larvae, other hundreds were sucked dry of blood by the grooved fangs of the water tigers; and the piercing beaks of the pearl-colored backswimmers had taken a great toll. To say nothing of those gobbled up by the bullheads and the snapping turtles and by the wide beaks of ducks, shoveling the mud of the shallows.

But in spite of all this, when the toad left the water, a whole army went with her, a host of fleshy, cricket-sized mites, hopping hopefully into the wet grass, each in search of a corner in which to live. Many never found that corner, for outside the water there were hungry grackles and hens, and minks, and frogs, and—one of the worst of all the toad's many enemies—the garter snake.



3 THEN THE AMAZING TONGUE, attached in front and free behind, flashes forth

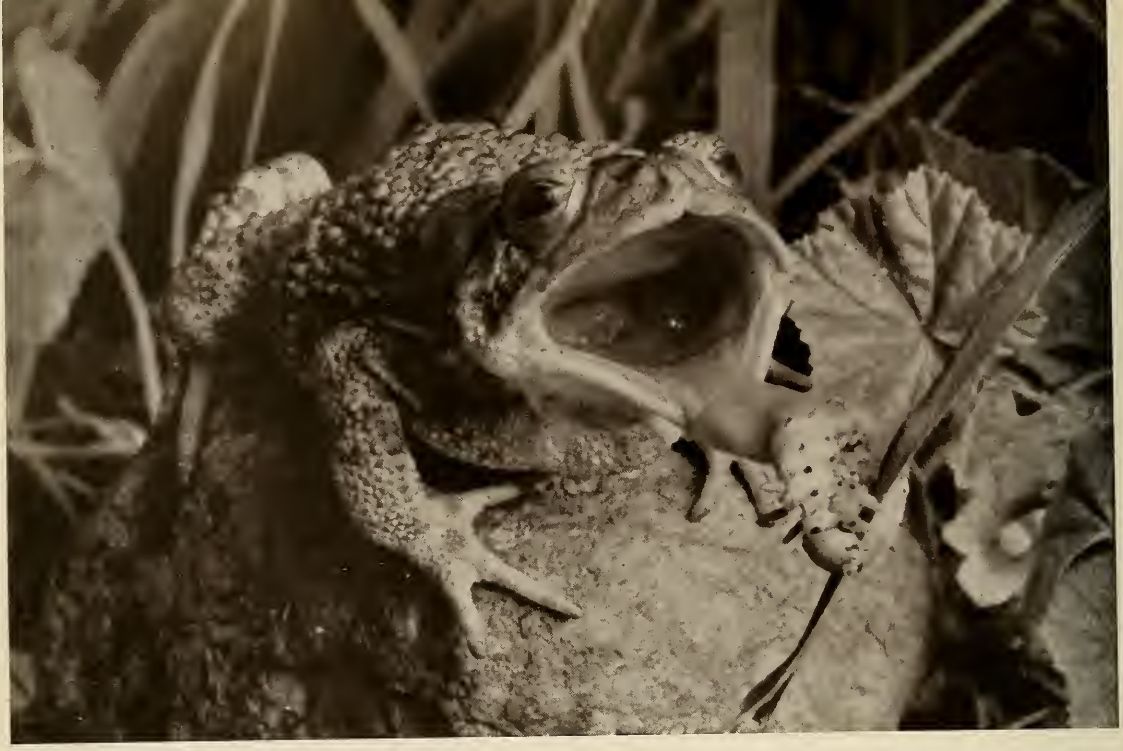
Yet day after day, still managing to escape the fate of her fellows, the toad hopped farther and farther from the water, until she came at last to a place where there was soft earth, and cutworms, and leaf hoppers, and lettuce and radishes, and wide, shady leaves of rhubarb. Here she settled down to live.

Thus the toad came to her garden in the spring.

The garden was the toad's universe. It was a tiny one, but as she prowled it of evenings or early mornings, she became increasingly aware of its texture and problems. It was a universe comprehended in part through her skin, which told her of variations in temperature and moisture, of things rough or smooth, and of those pleasant or painful to touch. As a tadpole, food had often meant a thing of odors; now these played little part in her life. When she did show discrimination, in either taste or smell, it was usually only to reject—sometimes when half-swallowed—certain noxious or foul-smelling bugs. Likewise, her ears told her that sounds played a part in the world. The singing of a cricket brought her a certain emotional and muscular awareness manifested by the quick cocking of her head or a slower rate of respiration.

But most of all, the toad's world was one of objects, of things seen. Her great golden, black-centered eyes gave her sharp images of the medley of forms around her—the plants, the gardener, the dog, garter snakes, other toads, and a whole assemblage of crawling things, the earthworms, the snails and slugs, and the insects. The toad's daily life was chiefly a complex of responses to these and to things felt through her skin.

Each evening, when the sun had dropped below the western rim and its glare had gone from the earth, the toad emerged from whatever leaf or cranny had concealed her during the daylight hours, and set forth upon a round of the garden. Hunger was the impelling motive of these nightly quests, but she always started off slowly, as if she knew that game was plentiful and that she had plenty of time. After a succession of short hops she would stop dead still and peer keenly about. When prey was sighted, she moved quickly toward it, her gait often changing to an awkward crawl as she drew near. If at the instant she was ready to strike a caterpillar, it suddenly decided as a defensive measure to curl up and play dead, the toad waited patiently until it again showed signs of life. Sometimes, indeed, she gave it up entirely as a dead thing and moved in search of something alive and active. For no matter how hungry she might be, she never struck at a non-moving object. The creatures upon which she fed, of course, didn't know of this strange "nothing moving, nothing eaten" peculiarity of the toad. Hence, when one moved, ever so little, within two inches of her head, her mouth would open, and her marvelous tongue—fastened at the front and free at the rear—would flash forth with the speed of a striking snake, its sticky surface winding about the victim and drawing it swiftly into her wide mouth.



4 THE TONGUE'S STICKY SURFACE captures the prey, and . . .

The toad had no teeth, hence everything entered her stomach in the same form it entered her mouth. The swallowing process, unbelievably enough, was greatly aided by her eyes, which invariably rolled deeply inward and backward during the act, thus forcing the struggling creature into her broad gullet. The number of animals captured of a night depended, of course, upon their size. She could swallow 50 ants or more without discomfort, whereas three or four average-size earthworms or several June beetles would temporarily gorge her to repletion. But her strong digestive juices worked rapidly, and if food was plentiful, she often ate enough to fill her stomach completely four times in 24 hours.

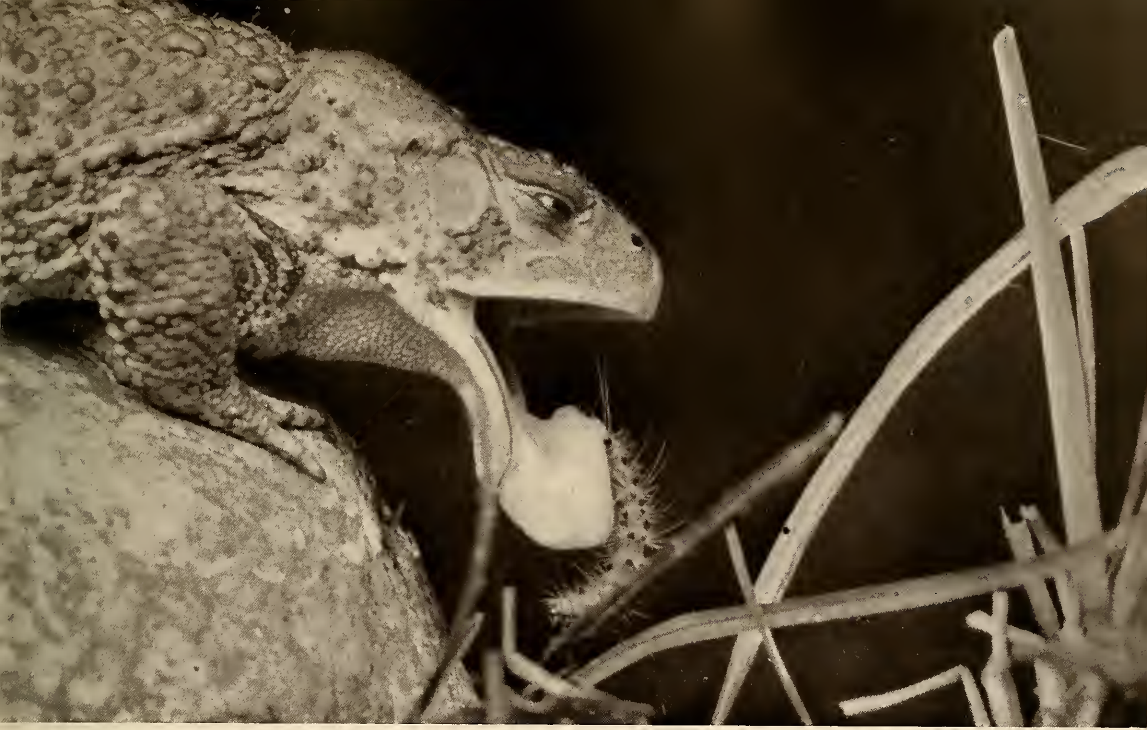
The toad's days were much alike. In her life there was probably little joy and little pain, but now and then came something to interrupt her quiet round of living: the gardener or his dog, for example. The gardener often dragged her bodily from her shady retreat to watch her sleepy eyes blink in the blinding sun. Sometimes, too, he carried her to the screen door and laughed as he held her in his hand, watching the house flies disappear like magic to the Lilliputian whipcracker reports of her flashing tongue. Sometimes he teased her by tickling her nose, chuckling gleefully as she lowered her head and butted clumsily at the offending straw.

The gardener's dog, also, now and then diverted himself with the toad by fishing her from the soil and barking and poking at her gingerly with tentative paws.

Often she inflated herself hugely as he mauled her, behaving as she did when a small garter snake attacked her. Sometimes, when overturned by his quick paw, she would play possum, lying belly up and quiet as if dead, even her breathing seemingly suspended. Once, when the dog had hurt her with his teeth, she had shown him one way a toad protects herself by giving off into his mouth a whitish fluid from the big glands on the back of her neck, and the memory of its awful taste had taught him never to take her in his mouth again.

The extreme heat and dryness of summer also affected the toad. She never drank in the manner of other animals; all the water her body required had to come to her through her food or directly by absorption through her skin, this last chiefly from wet plants or the damp soil. Also, since she was cold-blooded, her body warmed or cooled with the rise and fall of the temperature of the earth and air about her. Hence, hot, dry air and dry soil took water rapidly from her skin and made her miserable, so on such days she burrowed deeply to come to the earth's dampness, and remained hidden until the sun was well down and the dew had fallen.

Four times yearly there came another interregnum. This manifested itself to the toad's awareness by a sort of general tightening and pulling and constriction all over her body, as if her outer skin had become dry and shrunken. This told her that the moulting period had come; so to rid



5 THE TIP of it returns to the back of the mouth, and with it the caterpillar

herself of her old skin, she would sit with her back strongly arched, head bent downward, and feet drawn under her body. Her outer skin, already loosened beneath, would then split along the midline of head and back and belly, next from side to side at her rear, and lastly from arm to arm across her breast.

After the skin had split along these lines, she freed her hind legs from their covering by bringing them forward and then rubbing them forcibly backward against her belly, all the while opening her mouth widely and expanding her body in a kind of shrugging motion. The whole effect was to drag the loosened skin forward to the corners of her mouth where it was still attached and gradually sucked in. Next she would drag her front legs free, and then after a few prodigious gulpings she would swallow the skin all in one piece as the final act of the moult. Then as her discomfort passed and her new skin dried and darkened, she would sit erect once more, open her eyes widely, and go on about her living as if nothing unusual had happened.

Each year, usually in October, the toad found herself heavier and slower and sleepier, with less desire to eat, and pervaded by a vague uneasiness. Unknown to her, the fat of her body, a product of her many nightly feastings, had piled itself into two huge orange-colored masses near her kidneys, and sugar from the same source gorged her liver. The fat and sugar were her food reserve. Some of it would be built into the eggs she would lay in the spring, some would be slowly burned to warm her as she slept. For the time had now come to hibernate.

So, just as in summer she had burrowed backwards into the soil to avoid the heat and dryness, she now backed even deeper into an old burrow or, mayhap, even into a new one, to avoid the frost, boring deeply backwards and downwards until the earth dropped in and covered her head and half-filled the entrance, this later to be plugged yet further with leaves and snow.

Here she slept. As the days grew colder, she grew colder until she was stiff and insensible to her surroundings but never quite frozen. Her heart slowed until her blood barely moved through the vessels; the fires of her life burned low but never quite went out. She was sleeping against time—against the coming of April. Then, when the red-shouldered blackbirds were singing in the swamps, when the cowslips yellowed the meadow, the ferns were unrolling, and the new red leaves of the pond lilies were struggling upwards, she would awaken from her trance, come forth from her cell, cock her head, and listen once more to the shrill voices of male toads calling from the pond.

Then, too, possibly because of these voices and the pressure of the many eggs within her, she would journey again to the pond, place her eggs there in the water, and without once thinking of their further welfare, return again to her home in the garden. This is the way of the toad.

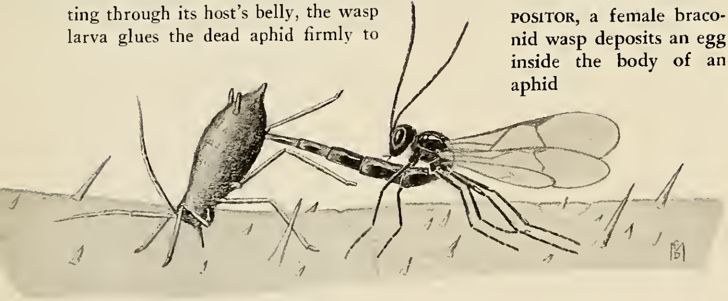
Upon this tiny stage, strange insects, with a brutal but effective precision, enact an even stranger drama of life—and death

Life on a Sunflower Leaf

By CHARLES D. MICHENER
and
MARY H. MICHENER

There is a sudden movement among the sluggish aphids. Several of the fat plant lice are rearing their bodies up and down in vain efforts to avoid a hurrying black menace. The enemy is a female braconid wasp no larger than the letter i. As she runs about she frequently stops behind an aphid to tap it with her rapidly vibrating antennae. If the aphid is suitable, she rises high off the leaf surface on her legs, curls her abdomen forward between them, and with her sharp ovipositor drives an egg into the body of the aphid. Then away she flies, leaving the aphid to return to its monotonous sucking of sunflower plant juices apparently none the worse for the stabbing.

In a very few days, however, the wasp egg becomes a larva which proceeds to eat the aphid alive from within. It is death for the aphid, which becomes bloated and dry. Cutting through its host's belly, the wasp larva glues the dead aphid firmly to the leaf. Its meal finished and home made secure, the larva draws back inside and rests for several days as a pupa. From this resting stage the wasp emerges as a winged adult ready to leave its aphid house. It cuts a neat round hole through the upper surface and crawls out. The disc cut out often remains weakly attached at one side like the lid of a tin can not quite cut free.



▼ **With her sharp ovipositor**, a female braconid wasp deposits an egg inside the body of an aphid

Now we see that in the aphid colony on our sunflower leaf there are many brown and bloated skeletons of parasitized aphids. Sometimes whole colonies of plant lice are destroyed by these braconids, but on our sunflower leaf less than five percent of the aphids have been parasitized.

Apparently only one wasp ever emerges from any one aphid. Perhaps the mother braconid can tell whether an aphid already is housing an egg or a larva, or it may be that only one larva can survive in case two or more eggs happen to be placed in one aphid.

All this occurred on a large leaf of a sunflower plant (*Helianthus annuus*) just outside our back door in Pasadena, California. The leaf is about midway up the stalk, green and as yet almost unblemished except for a slender, pale, serpentine streak which we recognize as the work of a leaf miner. The leaf miner, a tiny fly larva, left a narrow trail at the beginning, but we can see that it broadened as the growing miner ate its way between upper and lower surfaces of the leaf. At the broad end there is a pale blotch where the larva stopped to pupate, and in the lower epidermis of the leaf we see a tiny tear through which the little fly escaped.

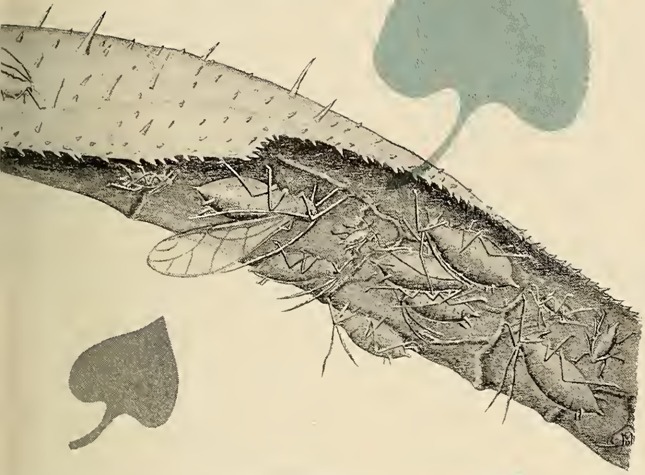
These aphids (or aphis) are known as sunflower aphids (*Aphis helianthi* Monell), a dark green or greenish black species especially common on this plant in southern California in the late summer. Some parts of the leaf are almost covered with them.

Exploring for a new homesite, a few winged aphids from another plant arrived on this leaf during the summer. Here they settled down to rear families. One by one the babies are born, active little nymphs, each looking much like its mother except for smaller size and lack of wings. We do not see the eggs, for they hatch within the mother's body.

All these youngsters are daughters, plump and green, who will never have wings. And strangely enough, all of these daughters are fatherless, for the mother aphid is able to produce young without mating. This process is called parthenogenesis. It is only in the fall of the year after numerous generations of females that, in most species of aphids, some sons are born to grow up and father the next generation. The eggs fertilized by these males do not hatch in the body of the female but are laid and survive the winter unhatched. Of course, our sunflower plant is an annual and will not be able to support the aphid families during the winter and next spring. In the fall, winged females leave the sunflower and fly to other plants on which the species can winter, perhaps only as eggs. The sunflower aphid in some places winters on dogwood, a plant which, however, is very scarce where our observations were made.

Looking closely at the sunflower leaf we see that both winged and wingless aphids are present. It seems that winged females are produced not only for the fall migration to a different species of plant but also from time to time in the course of the summer generations. Just what the needs or stimuli for the production of winged individuals might be, science does not yet fully understand, but these are some of the conditions that

Both winged and wingless aphids are seen together on the sunflower leaf. Most of them are on the under surface, but a few are among the minute spines of the upper surface



may influence it. There may be overcrowding in the aphid community and some will develop wings and leave, or the sunflower plant may weaken from disease or from the draining of its juices by the aphids themselves or poisoning from injected salivary substance. There is no carefully planned food rationing here; some must die or shove off and look for greener pastures. And in such emergencies nature issues wings to some to enable them to travel.

Life is just one long drink for an aphid. Its "cider" is plant juice and its "straw" a special arrangement of four slender mouthparts or stylets, which are enclosed in a heavy sheath when not in action. The stylets taken all together are far more slender than a human hair, yet they can penetrate plant tissues and they enclose a pair of tiny channels. Through one of these channels juices are sucked, and through the other saliva is injected into the plant.

After proteins and other food elements have been strained out of the plant juices in the aphid's body, the remaining sweet fluid is excreted through the anus. This liquid is known as honeydew, a soft drink much favored by certain ants and other insects. Just how the aphid's inside filtering system works we do not know, but it is clearly associated with the unique arrangement of the intestine characteristic of the Homoptera, the group of insects to which aphids belong. The gut (a perfectly respectable term in scientific circles) is looped back upon itself so that a very thin portion of the wall adjoins an equally thin wall of the fore part of the same tube. We may suppose that much of the water and sugar in the plant juice passes through these thin walls, taking a short cut to the anus, while food substances scarce in the plant juice but needed by the aphid are sent the full length of the gut, where they are digested and assimilated.

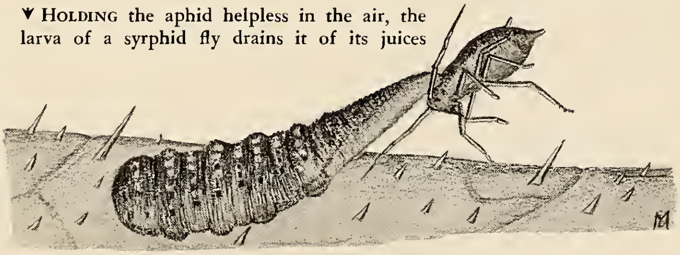
Honeydew is produced in great quantities, covering a large part of the leaf surface and providing food for many insects. It also serves as a nutrient medium in which various molds can grow. That dark band of little Argentine ants (*Iridomyrmex humilis* Mayr) which is flowing up and down the sunflower stem and branching out on each leaf petiole is in search of honeydew. We can see that each ant collects the fluid directly from aphids, its antennae patting each little "cow," apparently to induce it to excrete a drop. At once the drop is taken up by the ant. Abdomens of ants leaving the sunflower leaf are often noticeably paunchy compared to those of new arrivals, for ants store honeydew in their crops to carry it home to the nest.

Other visitors come to the bountiful syrup spread, such as stunning blue-green cuckoo wasps and the males of black and yellow wasps of the genus *Crabro* with their forelegs oddly expanded into large shields. These do not gather from the aphids directly but lap the honeydew from the leaf surface.

We have already seen that the braconid wasp (*Lysiphlebus*) is an insect that uses the aphids for its own benefit but, unlike the honeydew eaters, destroys the aphids. Another wasp that takes considerable toll of aphid lives is *Stigmius*, five or six times as big as the braconid but nevertheless under three-eighths of an inch long. It is black with a heavy squarish head. *Stigmius* does not parasitize the aphids but preys upon them as food for her young. In some near-by dead and broken stem she tunnels out a nest for her larvae. When the burrow is complete, it is stocked with an abundance of fresh aphid meat. We can watch her collect aphids from our sunflower leaf. With her jaws she grasps an aphid, stinging it almost at the same moment. Then she flies

Continued on page 144

Holding the aphid helpless in the air, the larva of a syrphid fly drains it of its juices



NEW HORI

A vast land whose problems are lack of irrigation and transportation rather than man-power, stirs with the desire for a place in the modern world and gives promise of rapid progress

In the heart of Asia lies a vast and remote area, approximately the size of our own United States, which for thousands of years has remained little known and little touched by the outside world.

I entered this land with my companion, Major William J. Morden, after two months of trekking over the Himalayas and the high Pamirs of Russian Turkestan. We dropped down through rugged gorges and were welcomed at the border by couriers dispatched by the Chinese Governor to meet us. As darkness fell amid a threatening thunderstorm, we galloped ahead for the nearest habitation, leaving our caravan to follow.

Riding rough trails at dangerous speed, I could see nothing in the utter blackness, not even my own horse beneath me. My only guide was the sound of hoofs ahead and the occasional sparks cast by their iron shoes. Flashes of lightning weirdly outlined rugged canyon walls, giving me glimpses of my companions ahead. In this intermittent blue light and amid the peals of thunder they were strangely like the Four Horsemen riding into a valley of death. Far below me to my left I caught the occasional glint of a mountain torrent. One misstep of my horse could plunge me to unknown depths.

Long, long afterward, we stopped by a ray of light. It came from a felt tent, or yurt, an official way station along the trail. We entered, wet and cold, and sat by its little but welcome central fire, while Turkomans in long, quilted robes and frizzly, furred caps made gestures of welcome in behalf of their Chinese superiors. There was much talking and activity. A great metal bowl filled with water was brought in and placed on the iron standards above the glowing fire of dried yak dung.

A bleating sheep was next dragged in. It was thrown to the floor in front of us, and its throat quickly cut with a long, sharp knife. Wooden bowls caught gushes of steaming

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* DR. JAMES L. CLARK, who is a native of Providence, Rhode Island, has traveled in many parts of the world other than those described in this article. In pursuance of museum objectives he has explored chiefly in Africa (four expeditions) and in Indo-China, and he has conducted many expeditions in our West, Northwest, and in Alaska. He has distinguished himself as a sculptor, taxidermist, lecturer, and motion picture engineer. In 1930 he was awarded the Speyer Memorial Prize in Sculpture. He is the author of *Trails of the Hunted* and is a contributor to many magazines. In 1942 and 1943 he served as Special Consultant, Army Air Forces Materiel Command, at Wright Field. He is responsible for the designing and construction of the American Museum's celebrated African and North American habitat exhibits.—Ed.

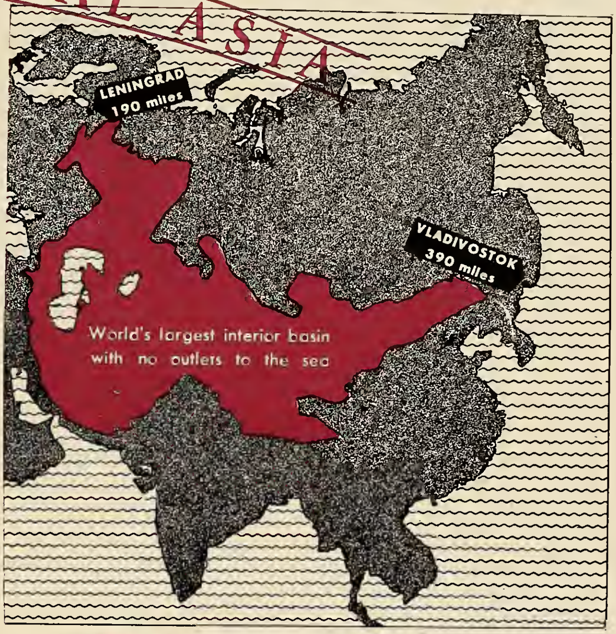
NS IN CENTRAL ASIA

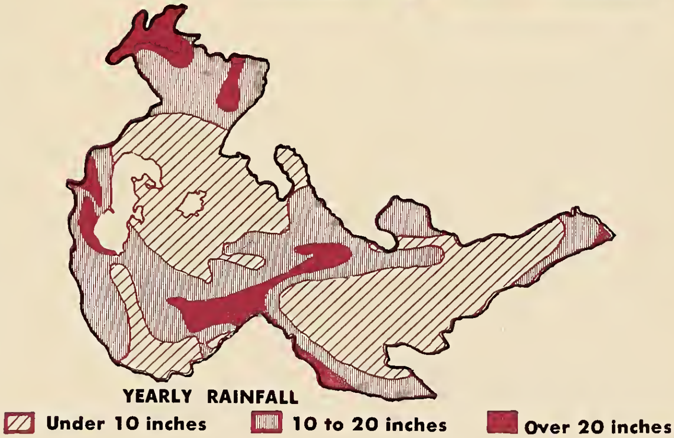
By JAMES L. CLARK*
Director of Preparation and Installation, The American Museum of Natural History

PHOTOGRAPHS BY MORDEN-CLARK EXPEDITION

◀ SOUTHERN GATEWAY TO CENTRAL ASIA: the Russian Pamirs, northwest of India. The photograph was taken at 15,000 feet, but the word "Pamirs" refers not to the mountains but to the high valleys. Into them come the nomads with their flocks for grazing through the summer. This is the land of the famous wild sheep, *Ovis poli,* or Marco Polo's sheep

➤ YOU CAN TRAVEL from about 190 miles east of Leningrad to within 390 miles of Vladivostok without ever finding a river that flows to the sea. What rivers there are in this vast interior basin either flow into salt lakes or dry up on the arid plains. Water is the major problem in the heart of Asia, as seen by the map below showing rainfall within the boundaries of this basin





blood. We were offered a drink, which we reluctantly sipped, in politeness. The sheep was rapidly and artfully skinned and cut up right before us, and chunk after chunk was cast into the cauldron. The odor of fresh blood was not pleasant.

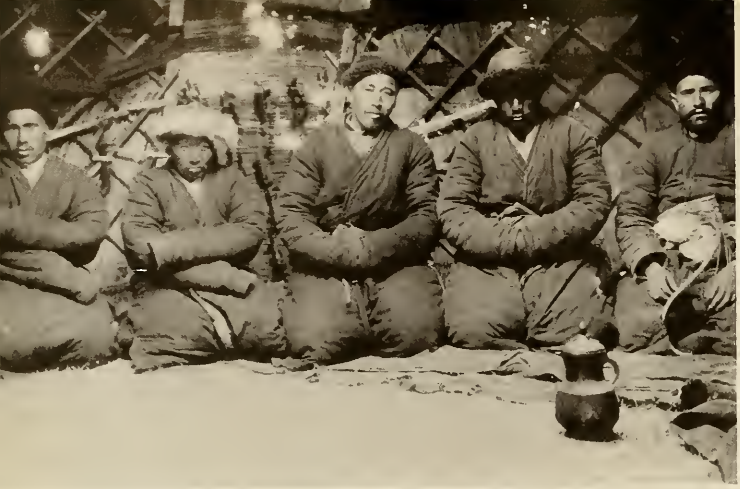
"What is this all about?" we asked of our own guide.

"In your honor, sirs," he replied. "The highest honor these people can pay you."

The light of the fire modeled the strong, brown faces of these mountainmen about us. Their long, maroon-colored coats, with sash about the middle, and baggy pantaloons tucked into the tops of sturdy leather boots, seemed to suit them well.

The framework of sticks and the thick felt covering of the yurt were stained brown with smoke. Chattels and articles of clothing hung on the latticed palings that supported the wall, while felt bedding and wooden chests lay scattered about the edges. Our hosts jabbered and smoked, as we sat courteously partaking of dried raisins, currants, almonds, and a native wine, while awaiting the real feast that was to come. Well could we have been with Marco Polo, for the centuries that had passed had brought not a single change to this dim and primitive setting of Central Asian hospitality.

This vast area, surrounded as it is by the "golden fringe" of the fabulously rich countries of China, Malaysia, India, and Persia, with immense expanses of steppe country to the west and Siberia to the north, has been, by its very geographical position, deprived of easy trade routes that might have brought to it the benefits of a more progressive outside world. Distances from within were too great for its people to venture much beyond their own borders, and it was only by relays of caravans from without that foreign contacts were made at all. To the south lay the world's highest mountain wall, an effective barrier to intercourse with the prospering peoples around the Indian Ocean. To the north stretched Siberia, a land of primitive hunters, uninviting and with



▲ **The reception committee** of Kirghiz gentlemen who greeted the author on the Morden-Clark Expedition. Airplanes now bring western civilization to some of these remote sections, which a short while ago could only be reached by long and difficult travel on horseback. Note the lattice framework of this typical yurt or felt tent, whose construction is shown below

little to offer. Only from China and from Russia and the Near East were contacts at all possible, and then only after tediously long caravan journeys.

Protected thus by this ring of space, strife came to them from within rather than from without, and their tribal and religious wars were quite bad enough. It was here that the great hordes of horsemen of Attila, Tamerlane, and Genghis Khan surged back and forth, spreading terror and death while conquering all before them. These horsemen of the Huns, trained to sleep in the saddle and live off the land as they passed, ruled intermittently for centuries, safe from the dangers of invasion or defeat. They alone were able to move with such strength and swiftness that the foot armies of other peoples were no match for them.

Geographically, this vast area is a tableland divided through its center by the western end of the beautiful Tian Shan Mountains, rising to some 20,000 feet. To the east lies the Chinese territory of Sinkiang, sloping gradually to join the borders of the Mongolian Gobi and the western provinces of China. To the west, the steppe countries of the Tartars and Turkomans roll on to the Caspian Sea and the Ural Mountains.

Although the Chinese filtered through to this promised land as far as the Tian Shan early in the third century, and possibly long before, and predominated as the most cultured class, they have only intermittently ruled it for something less than five centuries.

To Marco Polo came the first opportunity of penetrating this little-known land, while on his way to the silkened courts of China; and of its peoples and their secluded world he has very ably recounted.

It was still to remain unchanged, however, for there was nothing to alter the slow pace of the camels or shorten the distances they had to travel. There were no ships to come from across the sea, nor roads by which a more progressive civilization could gradually encroach upon them.

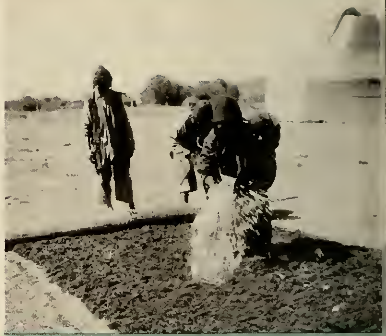
These people early took to irrigation above the banks of the rivers and at their very ends, where the silt-laden waters deposited great fans of deep and rich alluvial soil. Here they built their bazaar cities and trading centers and lived largely the life of agriculturists. In the more fertile valleys of the hill country, there were nomads and hunters. In the flat country, dust bowls and deserts stifled their progress, but they found a balance under which they could perpetuate themselves, if not grow.

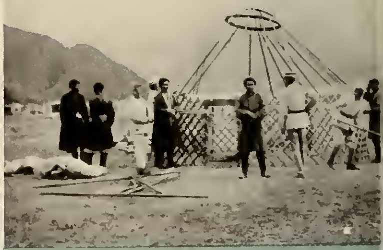
Not until the latter part of the nineteenth century did infiltration

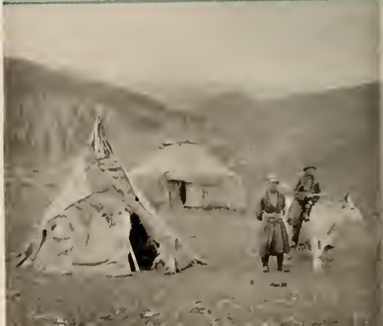
▼ **To make the felt covering**
"munda," wool of sheep, goat, or camel
sprinkled with water and rolled up on
long pole. The ends of the pole are ha
nessed to a camel, and it is rolled ov
flat ground to entwine and compress t
hair

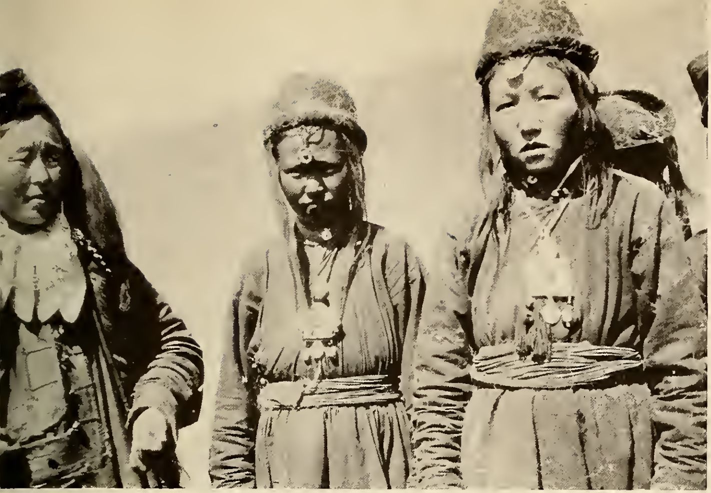
▼ **The framework** is collapsible, and t
whole house can be transported on t
backs of bullocks, camels, or yaks. T
yurt is the nomad's home over most
Central Asia

▼ **The felt covering** is good insulati
from the cold, so the dwelling is warm
well as roomy. For temporary stops,
shelter shaped like the Indian tepee
sometimes erected (*foreground*)









▲ **Kalmuks of Sinkiang**: a strongly Mongoloid type of wholly nomadic people. The big switches of horsehair tied to her own locks show that the woman on the left is married; the other two are not. The Kalmuks are fine hunters and bring in the furs from the mountains. They are Buddhists

◄ **Kalmuk children** on the pasture lands of the Tian Shan

▼ **The Kalmuk woman** in the center wears a switch of horsehair across her eyes, which in this case are probably weak or sore. Throughout Central Asia this primitive but effective method is used to protect the eyes from glaring snow. The Kalmuks number something under 200,000 and live in the uplands. Some of them have a fondness for appropriating the horses of other people

from without begin to change their future. In 1868 the Russians took serious interest in the potentialities of the region and moved down with their armies. Many hard battles were fought before the last great oasis city of Samarkand finally fell under their dominion, which gave them control of the whole western area up to the Chinese Tian Shan.

Europeans now became interested, and courageous explorers ventured in over long and wearisome routes to study the land and its people. With their protective belt of vastness penetrated, their isolation began to wane, but their mode and tempo of life followed the same pattern as it did in Biblical times.

Not until World War II, which has left no portion of the globe untouched, did Central Asia really become conscious of any change. Now its people, in parts at least, shaken violently from their ancient slumber, are becoming a part of our world. Now vast changes are beginning to take place. All of Asia is awakened—aroused and quickened by the reverberations of war.

Ancient caravan routes have become highways. Fleets of heavily laden trucks now speed across the old silk routes in clouds of dust, doing in a day what the caravans did in a month. On the Russian side, railroads are reaching their tentacles ever farther, and planes shorten months into hours. Central Asia is now shrinking with the rest of our world. The change has come upon it with a sharp crescendo in the last two or three years.

The transition is not a slow one. These people are being swept right off their feet and, dazed by it all, are no doubt wondering what it is all about. Gradually they will adjust themselves, for many are of a sturdy and progressive type, who can and will accept a progress that will bring benefit to all. Development will be rapid, for everything that the outside world has to offer will be all new to them, and they will absorb it at a fast rate, in their old homes and new industries.

Education, which has had a good start under the Russians but somewhat less in the Chinese territory, is now expanding. The old and fiery religious antipathies, which have burned so deeply, will now wane, and more concerted action will result.

Since Russia took over the westernmost steppe countries, this area has been politically divided on the maps as Russian and Chinese Turkestan. Sinkiang (the New Territory, as the Chinese prefer to call it), lying to the east, holds the still primitive bazaar cities of Khotan, Yarkand, Kashgar, Aksu, Karashahr, and Urumchi, its capital. In the Russian domain are the larger and somewhat more sophisticated cities of Samarkand, Tashkent, Bokhara, and the lesser ones of Andyan, Verny, and Kuldja. A few years before the present war, the Soviet Union through intrigue, was successful in extending its political influence into Sinkiang, but recently, by a most promising gesture of good faith toward mankind, it has returned complete control to the Chinese.

To this newly opened land, trade will flow from Russia, from Siberia, and from China. The great barrier wall to the south, more effective than oceans or deserts, precludes even in modern times a free intercourse in this direction.

Specialists, engineers, and technicians of many kinds and from many lands, will be needed for vast new enterprises in road building, hydroelectric power and irrigation projects, mining, large-scale agricultural developments, and many other activities, for it is wide open for all modern improvements and the benefits they offer. Now, with but a few million people, there is room for many more. Good and sturdy labor is already at hand, and the people will serve well to enjoy a prosperity never before known to them.

When the development of this new land joins with the potentialities of Russia, Siberia, and China, there will come into being one compact sphere of influence with resources so varied and extensive as to stagger the imagination.

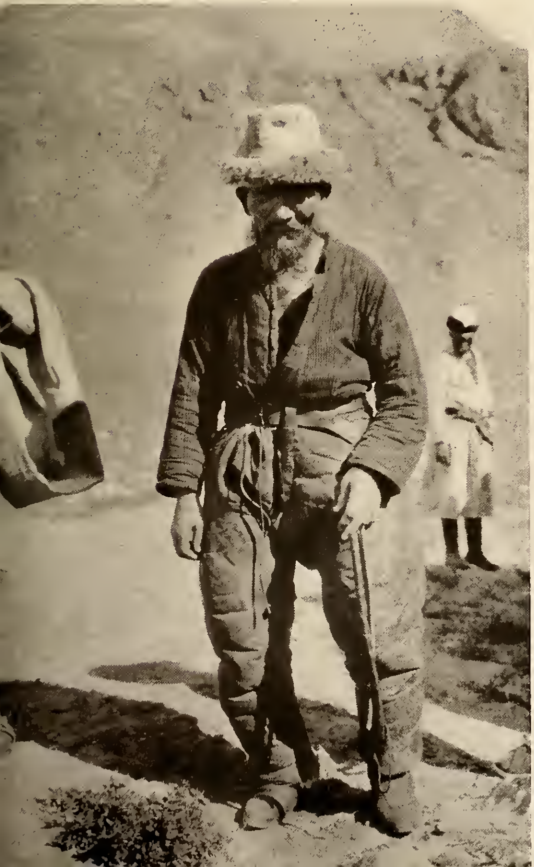
But for the present, water is the sad story and will continue to be for some time. No rivers that flow from within this whole great area ever reach the sea. Waters that are not sapped for irrigation finally dissipate themselves into thirsty sands. Engineers can and will remedy the water shortage by going back in the mountains where there is an unlimited supply from perpetual snows. They will dam the deep gorges for power and irrigation projects. When this is done, great areas of arid waste will become lands of plenty. New industries, with raw materials and power at hand, will bring progress and wealth.

◄ A Kirghiz hunter with matchlock rifle and forked rest. The Kirghiz are a herding people of the mountains in Southwestern Sinkiang. They are quite Mongoloid but are Mohammedans

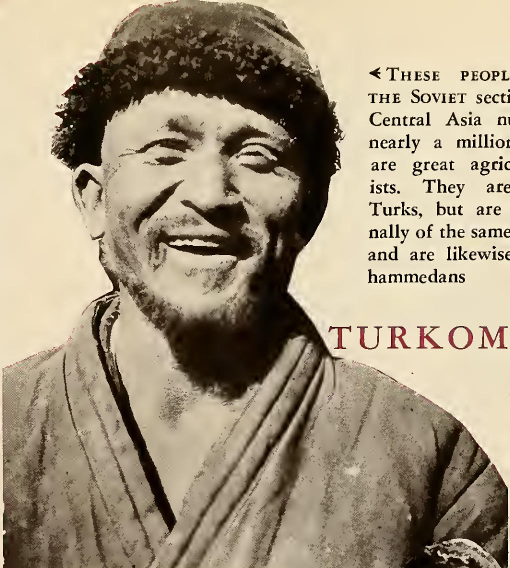
► Typical of the Chinese ruling class is this Amban (magistrate) of the walled city of Karasha, Sinkiang. The Chinese of Sinkiang number some 200,000 and predominate also as merchants

▼ A Kazak family in the Tian Shan. While the men are out hunting or herding the cattle and horses, the women do chores at the camp. Children herd the sheep and goats near-by. The Kazaks number about 800,000. Some of them live in Sinkiang, but most are in Soviet territory to the west

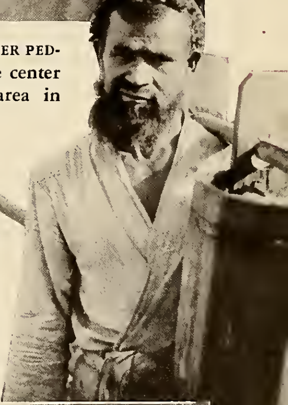
▼ THE EXPEDITION'S KAZAK HUNTER, "Tulabai," of the Tian Shan. The Kazaks are nomads and live in the grasslands of the higher country. They are only slightly Mongoloid in appearance. Many have light skin and blue eyes



TURKOMANS

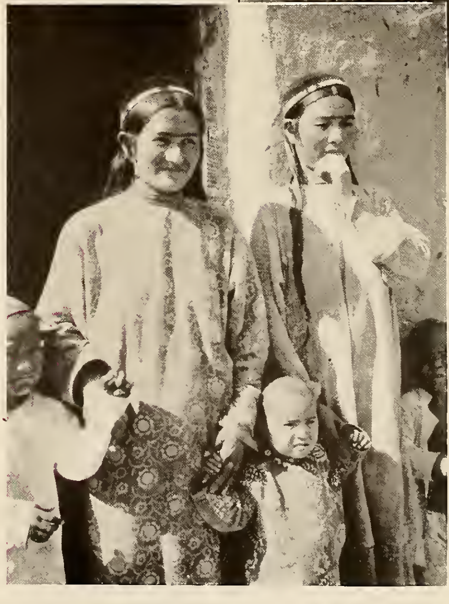


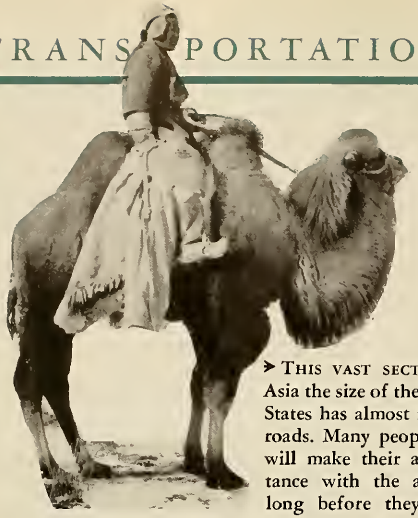
◄ THESE PEOPLE OF THE SOVIET section of Central Asia number nearly a million and are great agriculturists. They are not Turks, but are originally of the same stock and are likewise Mohammedans

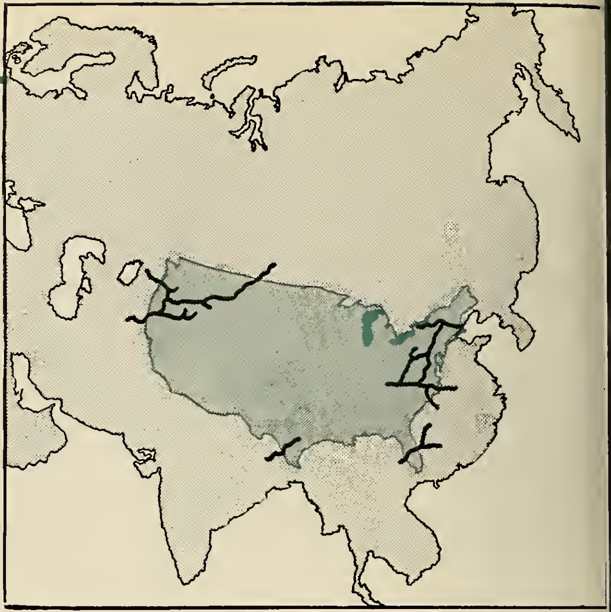


► A TURKOMAN WATER PEDDLER of Kashgar, the center of the Turkoman area in Sinkiang

▼ TURKI WOMEN AND CHILDREN of Sinkiang. They have straight black hair, and many are attractive. Their garments, either homespun or procured through trade, are cotton cloth







➤ This vast section of Asia the size of the United States has almost no railroads. Many people in it will make their acquaintance with the airplane long before they see a locomotive or automobile

▲ A Mongolian dandy on his well-bred camel. These riding camels travel at a much faster rate than the ordinary freight camels and are sometimes referred to as express camels

Some of the larger, strictly desert wastes must remain as such for a long time, but they may eventually prove to hold their potential wealth below the ground instead of on its surface.

As regards minerals, the whole region is untouched, yet many resources are known to exist there. Coal is mined from shallow shafts, and oil is already taken and crudely refined from surface wells, with indications that it is present in vast quantities.

Much of the country will remain as grazing lands, for there is much rich pasture. Lying in the same latitudes as the United States, the temperate climate has produced in the valleys some marvelous grasslands, where the Kazaks and Kulmuks already raise fine horses, cattle, sheep, and goats.

Unfortunately the Asiatic is hard on forests, for he is forever cutting down but not planting; and the first thing that Central Asia must be taught is conservation. There still remain in the Tian Shan stands of fine big spruce, some five feet in diameter. But these are only a fraction of the timber that once covered large areas. Evidence shows that many of the now barren grass stretches were once entirely forest grown; but fires, which burn unchecked and sometimes are set by natives for reasons unknown, are rapidly reducing what is left.

Here in this temperate belt is enjoyed the same healthy, invigorating climate as our own, in which a great majority of man's food supplies can be produced. Varying altitudes and soils provide a wide range for both food and industrial crops.

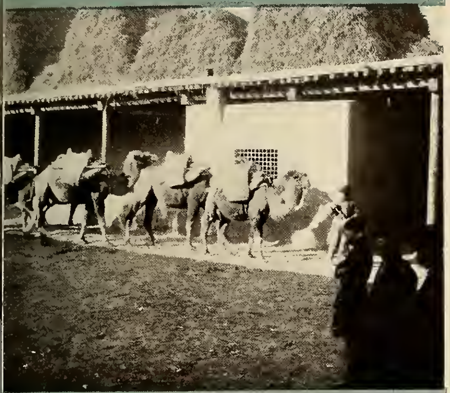
As a field for research in natural science, Central Asia is as yet quite virgin territory. Here we may find, in fossil form, remains of earliest man.

Now that there is come to the New Territory of Sinkiang and Russian Tartary a younger and more progressive group of Chinese and Russians, educated and trained in agricultural, industrial, and governmental affairs, this long-dormant land can look forward to an unbounded period of progress and prosperity. A real future lies before it.

▼ The ships of the desert take on water at widely spaced wells. In much of the flat desert country, water can be found eight or ten feet below the surface. When it is brought up, it is emptied into shallow enclosures where many heads can be watered at one time

▼ The opening to the shallow well and the vessels with which the water is bailed out can be seen in the foreground

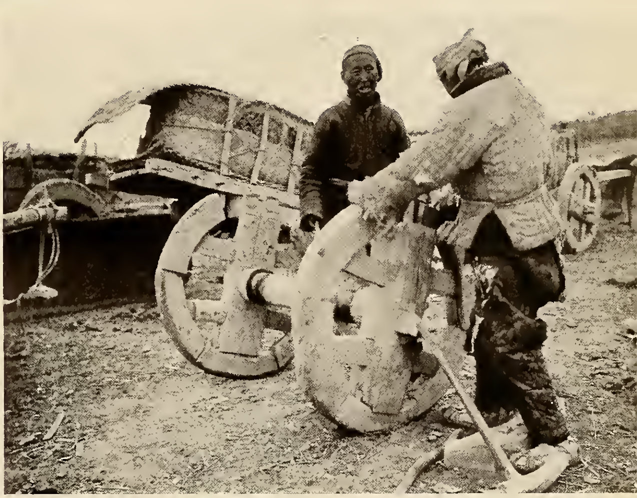
▼ A camel train with pack saddles waiting to be loaded. The hay stacks are piled atop the roof of the compound, safely out of reach of the ever hungry beasts of burden



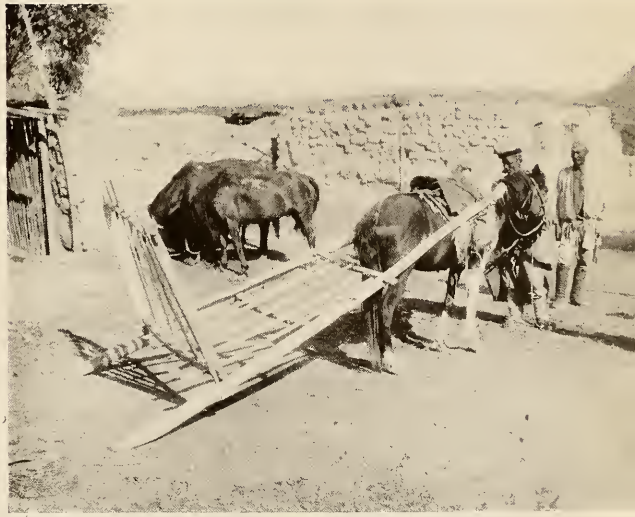
▼ Camel trains that carry freight up to 600 pounds to a camel travel day and night, winter and summer. In the extremely low temperatures they increase their average of two-and-one-half miles an hour to three

▼ Occasionally caravans encounter difficult and dangerous going. Here the natives are helping one of their loaded beasts across a treacherous river flowing from the mountain gorges

▲ The fast express of Central Asia: *telagas* drawn by three horses. These little wagons carry the mail, light articles, and a few passengers. The horses are kept at a trot and frequently changed. These four carts with the same horses made 150 miles in three days with the expedition's baggage



▲ Heavy freighting is done by the Chinese with primitive carts. The heavy wheels (here being repaired) have a stationary axle, and the load is carried in a bathtub-shaped basket. A single bullock draws each cart. These carts travel mostly in the cool of the night, and frequently 100 or more of them move in a group, presumably for protection from bandits



▲ The Indians "travois" in Central Asia. These wheelless conveyances are mostly used for hauling hay from the fields

▲ **Fine grass lands** and timbered slopes are found in the valleys of the Tian Shan Mountains. Here in an area as large, as fertile, and as beautiful as Switzerland a great many people can live in health, happiness, and prosperity, for the country has everything

↗ (*Upper right*) **The well-watered Tekes Valley** in the Tian Shan Mountains abounds in rich pastoral land, but trails, bridges, and other facilities for travel are primitive

GRAZING LAND

▲ **Kazak horsemen** in the grazing country of the Tian Shan. The Kazaks are nomads and have great herds of horses, as well as cattle and sheep. They ferment mare's milk and make kumiss, which is used as an intoxicating beverage

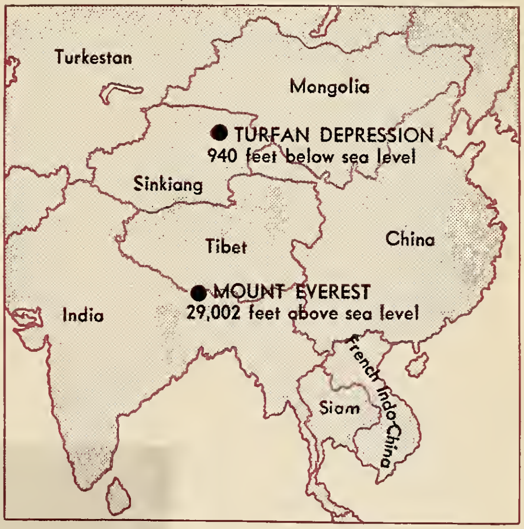
▼ **Kalmuk children** of the Eastern Tian Shan on their riding bullocks, on which they follow the herds of sheep and goats during the sunlight hours

▼ **Amid unsurpassed alpine** scenery these Kazaks likewise perform the duties of the herdsman on the backs of bullocks

➤ Outside the walls of Kashgar, the farmers grow their garden crops between irrigated ditches laid lengthwise through their fields

▼ A view showing only a part of the rich irrigated fields around Kashgar, a city of some 80,000 inhabitants. The Kashgar River flows through an area of about 2500 square miles that is largely made up of windblown soil, or loess. In the center of the city a very large spring of clear water flows from the earth and is properly protected and guarded from contamination

➤ The Turfan Depression is a flat, arid basin that reaches a depth of about 940 feet below sea level at the lowest point. It is 1000 miles almost due north of the world's highest mountain


Turkestan
Mongolia
TURFAN DEPRESSION
940 feet below sea level
Sinkiang
Tibet
China
India
MOUNT EVEREST
29,002 feet above sea level
French Indo-China
Siam

◄ Primitive methods of tilling the soil linger. Here is shown a native with his bullocks drawing an all-wood plow in the great Turfan Depression

◄ THESE CANYONS in the mountains flanking the plains could be dammed and stored with permanent water for irrigating the sections suitable to agriculture

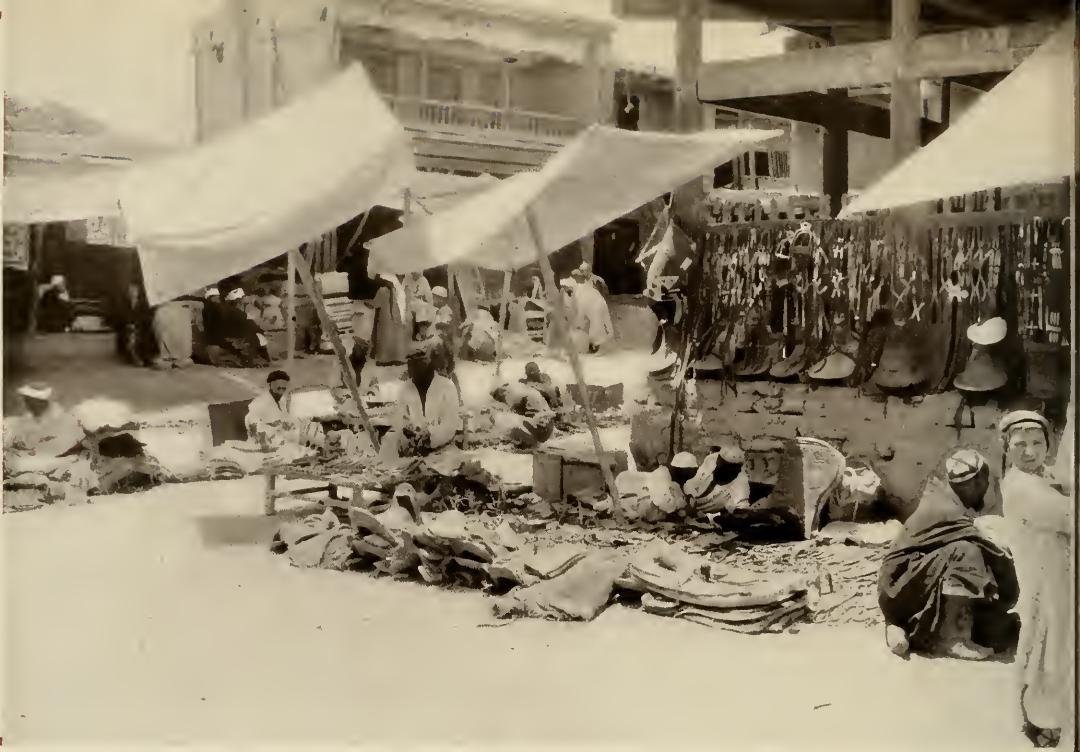
➤ THIS VIEW IS TYPICAL of the flat, arid plains that cover much of Central Asia. Water would transform some of them into great agricultural areas, and they may prove to be even richer beneath the surface, in minerals or oil

▼ THE NATIVES have appropriately called this area "Trees of Rock" (Kargai Tash). Its interesting topographic features remind one of arid mountain sections in our own West

⮝ A **DONKEY CARAVAN** stops for a rest in a grassy valley of the Tian Shan. Much of this beautiful and fertile country, now utilized only for grazing, is potentially valuable for many other uses

➤ A **SWEEPING VALLEY** that would satisfy the eye of anyone seeking mountain scenery. To the left can be seen a flock of sheep

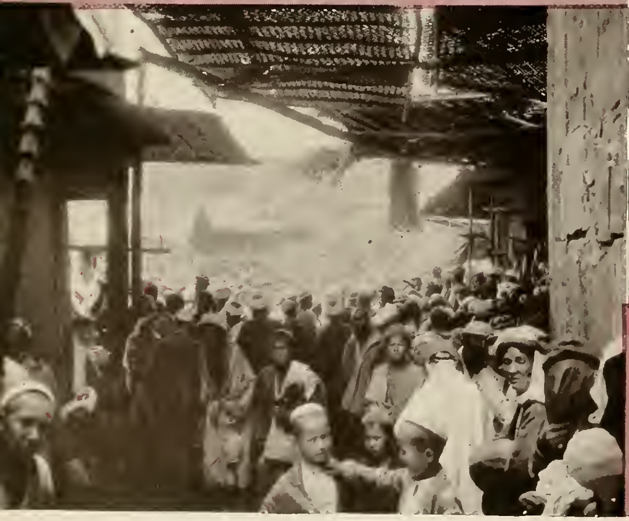
⮜ A **CAMPSITE** along the route of the Morden-Clark Expedition, in the big spruces of the Tian Shan. Abundant wood, water, and grass make this area perhaps the biggest and best garden spot in Central Asia

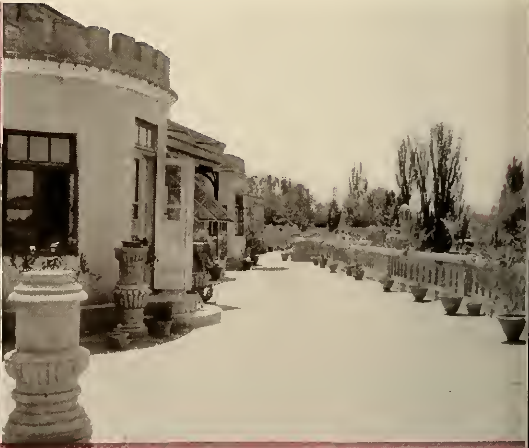


▲ Typical of the bazaar cities of Central Asia are these little shops or stalls of Kashgar, in which the vendors spread their goods wherever traffic will permit. Melons, grapes, apricots, pears, and apples are sold here, as well as dried fruits and almonds

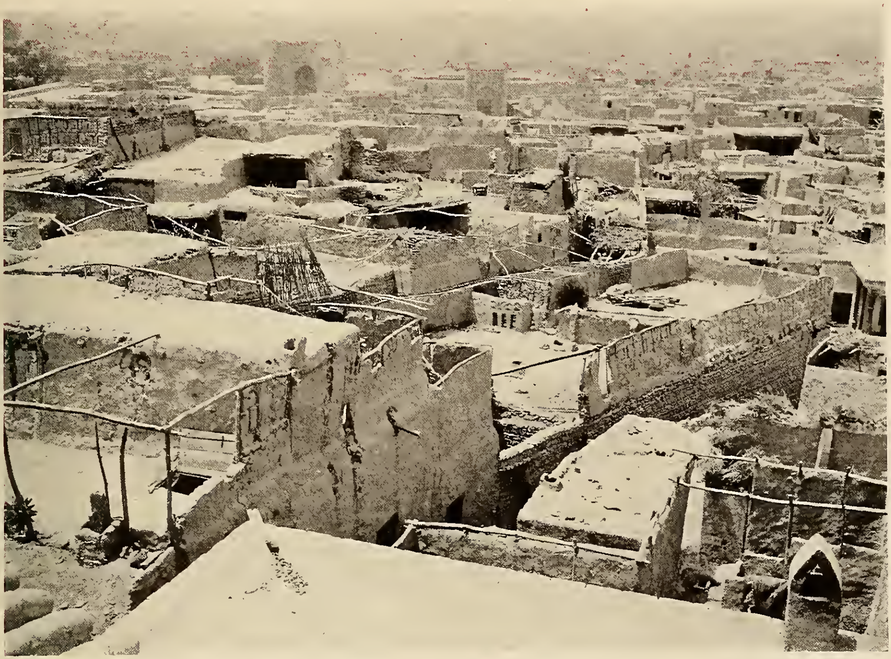
KA

▼ Market day. This city in the southwest corner of Sinkiang is inhabited almost entirely by Turkomans. The brushwood greens shield the narrow streets from the intense heat of the summer sun





▲ The home of the British Consul in Kashgar. Only foreign officials have such pretentious habitations

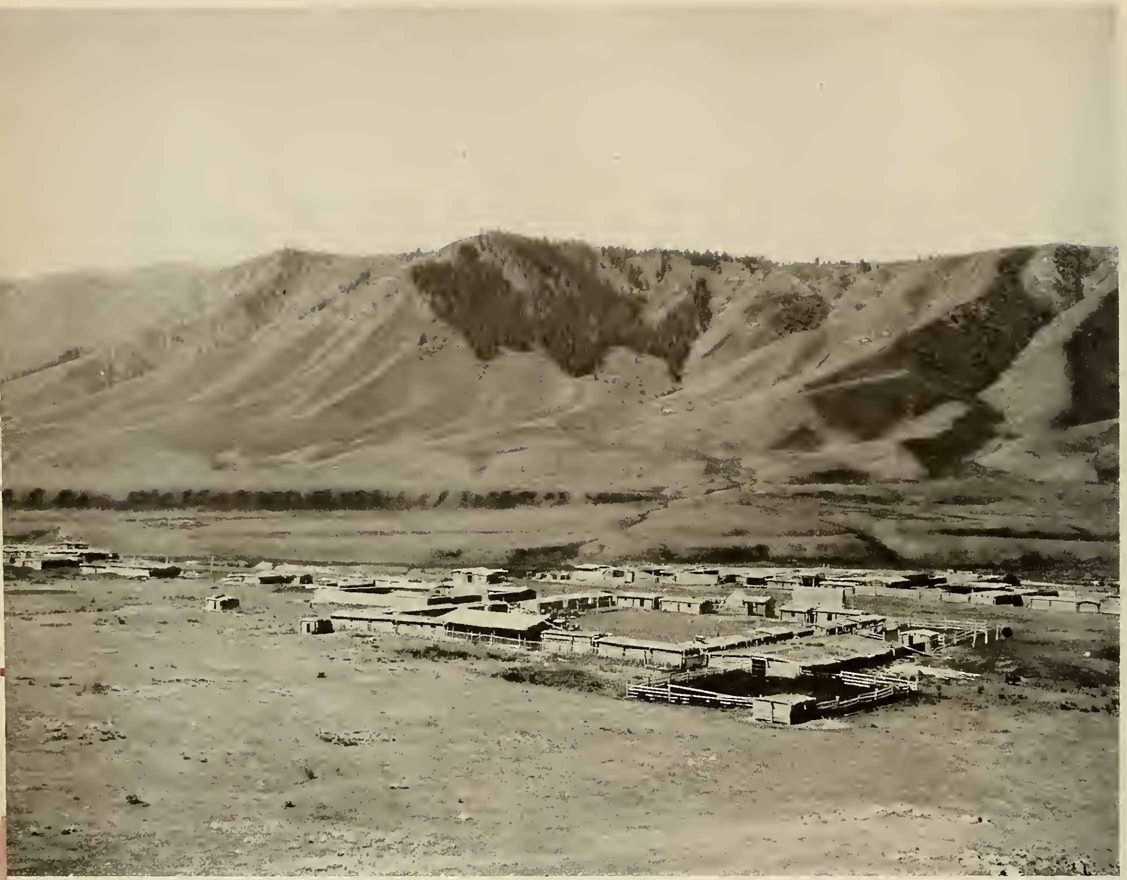


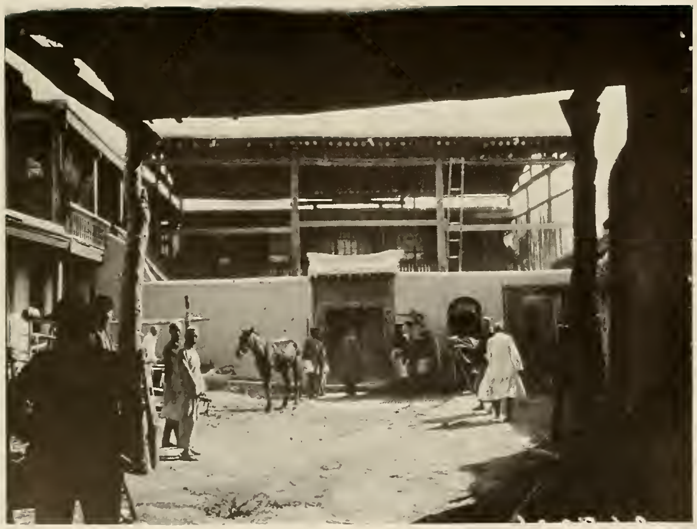
➤ THE CITIES are built of sundried brick over a structure of beams and sticks. A view looking over the housetops of Kashgar

R

➤ BIG TREES shade the adobe houses of the city's "residential" section. Ladies and gentlemen of the better class ride their donkeys while shopping. The very wealthy ride in their closed *mappas*, highly decorated carts of the elite

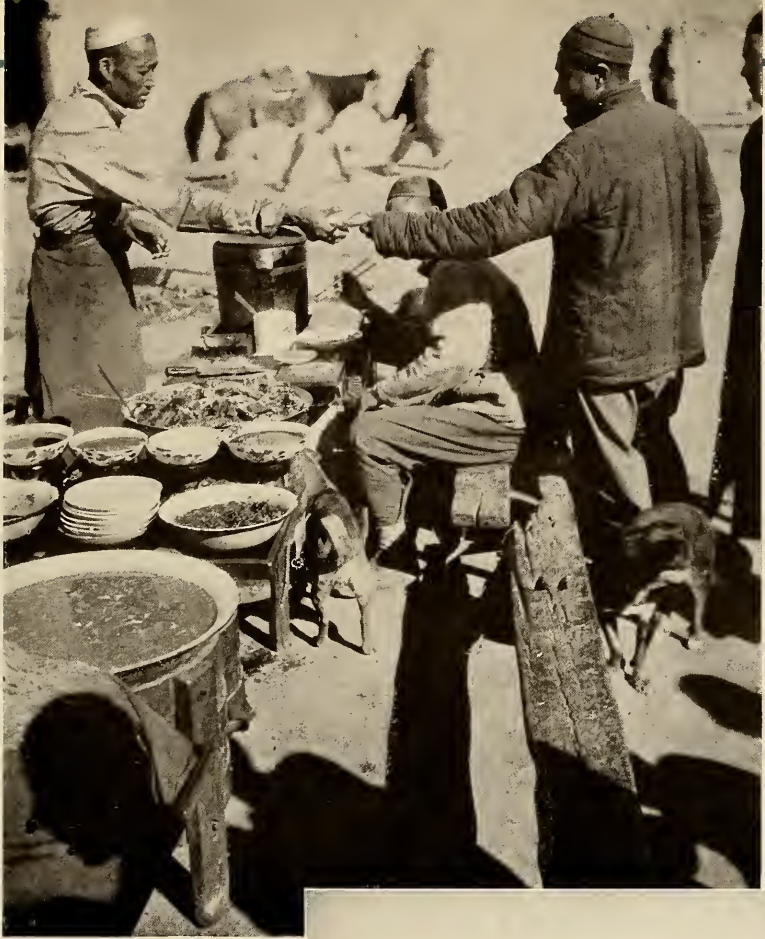
➤ DONKEYS are the typical carriers on Kashgar's boulevards and byways





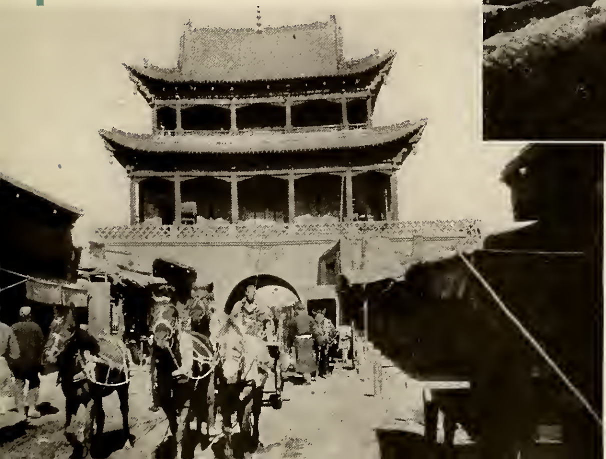
▲ THE LITTLE CHINESE military post of Shutta lies in the Tekes Valley of the Tian Shan and controls this area close to the Soviet border. Remnants can be seen of a magnificent forest, which once covered all these hills. Although the slopes are now turned into grassland, erosion will soon start to wash away the rich soil

◀ RESIDENCE of the Chinese Amban, or magistrate, of Karasha. It is customary in this region to build around a yard or compound, which is entered through a gateway from the street



▲ An open-air restaurant in the streets of Urumchi. Eating places of this sort are typical of the Chinese cities and are always well patronized

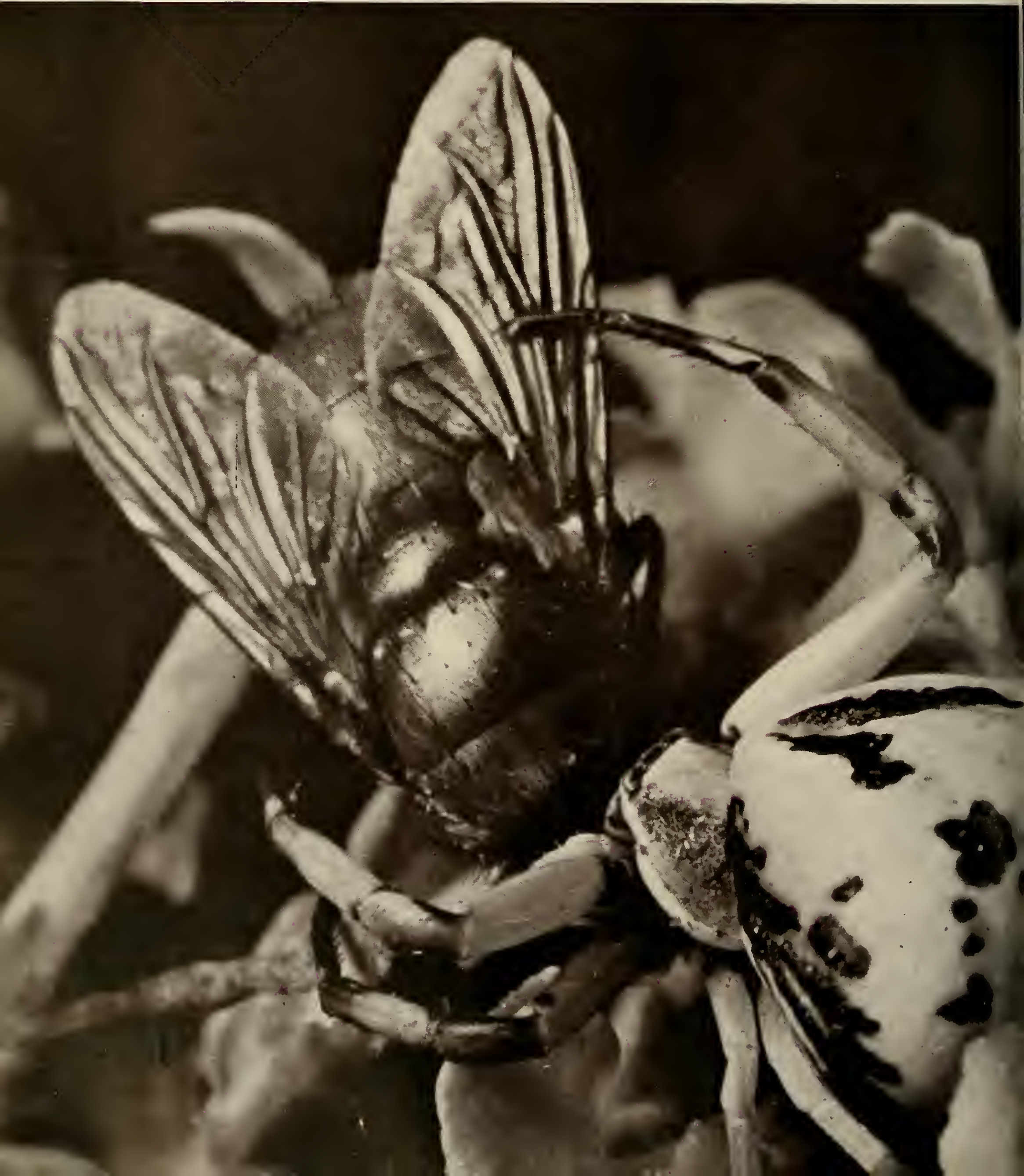
➤ The great wall around Urumchi here separates some residences and gardens from the domain of the "outcasts" outside the enclosure



◀ The main gateway to the city of Urumchi, seen from within. The architectural pattern of these inland cities, like the tempo of life in them, is linked closely to the days of Marco Polo. But the era may not be far off when visitors will be whisked through this ancient portal from the local airport

nature *through the* CAMER

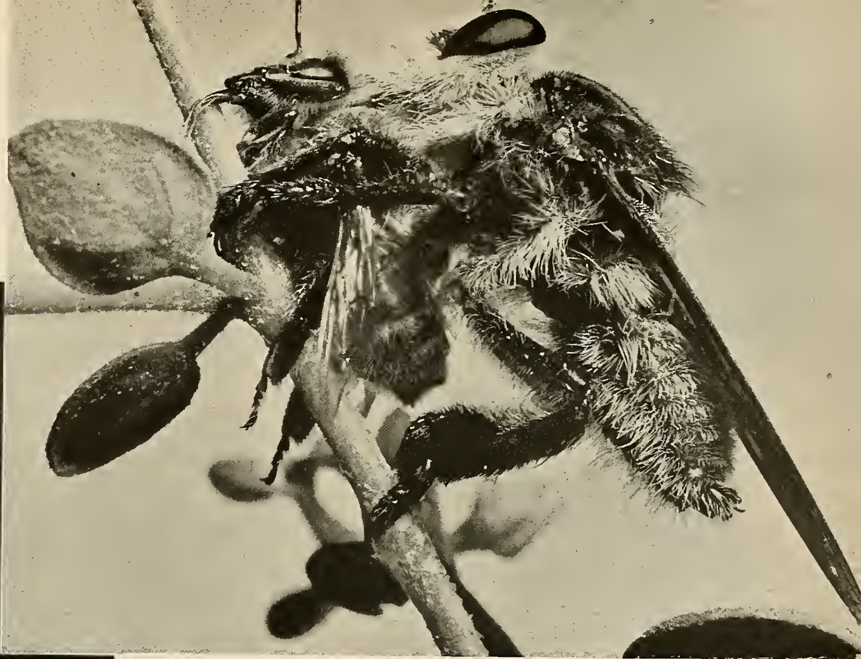
▼ Crab Spider and Fly



e insects with their prey

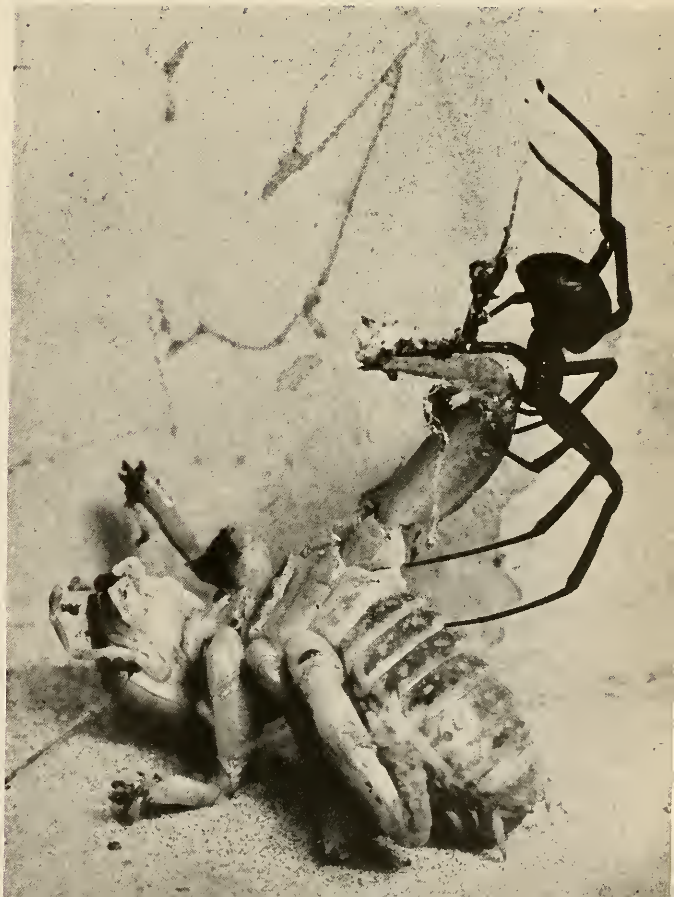
EYE

By RICHARD L. CASSELL



▲ Robber Fly and Honey Bee

▼ Black Widow Spider and Jerusalem cricket



Save it with Flash

By THANE L. BIERWERT
Acting Chief, Division of Photography, The American Museum of Natural History

TRAMP, tramp, tramp, the photographers are marching from store to store, searching for a roll of film or a sheet of paper. It's a great day when they find something in stock. And we have been warned that the situation will become steadily worse.

The important thing today is to hit every exposure squarely. Gone are the days of shooting twelve in order to get one good picture. You can't hike from store to store all the time. Remember that good shoe-leather is among the missing, too.

Suppose you do run across some film. Do you know how to make every exposure good? Improve your methods by carefully analyzing each subject. The old "by-guess and by-gosh" technique is too haphazard. Use your notebook and pencil again, as you did in the beginning days of your photographic hobby. If you have already mastered your technique, that is, if you know how your equipment operates, how your favorite film is exposed, and what you can photograph best, then you will have few difficulties. However, not all of us are so fortunate. Here is what can be done to conserve film and still have many pictures.

We should resolve to make no landscape or pictorial exposures if there is a possibility that we can return to the area at a more propitious time. If you must expose, diligently consult the exposure guides that come with the film. If possible, use a precise exposure meter, taking care to measure only the light in the sections of the picture that are most important. Even then, check the meter reading against the exposure guides to catch any slip on your part. Before making the exposure, be certain that your viewpoint is the best possible for the scene. Make only one exposure, whether you have color or black-and-white film.

When you have a new baby in the house, or if you are making pictures of the family to send to a man overseas, it is imperative that every exposure count. The way to get good exposures is by having enough light to work with, ensuring short exposures that will stop movement of the subject. Sunlight makes for short exposures, but we cannot have it every day, and we cannot move it around very easily if we wish to vary the direction of the lighting. However, we can use "canned sunshine," in the form of flash bulbs. Fortunately these are procurable once again. If a few simple rules are followed, every exposure can be correct. It is then merely a matter of exposing at the crucial moment.

Correct exposures are possible because we are working with known elements: (1) the film has a definite emulsion speed or rating; (2) each flash bulb has a uniform brightness and duration, and (3) we work at measurable distances. With these three factors we are able to find our unknown quantity, the exposure. In order to understand how flash bulbs can guarantee good exposures, let us follow the steps in an example.

Flash bulbs can be used on ordinary house current, unless marked otherwise, and they have a flash duration of about one-fiftieth of a second. A flash synchronizer is not necessary for flash pictures; "open flash" pictures are possible indoors with every camera. They are taken by opening the shutter on "bulb," setting off the flash with the other hand, and then closing the shutter. Buy several G. E. 22's or Wabash "Press 40's." These are medium-size bulbs with a retail price of 11 to 18 cents. They can be used in a gooseneck desk lamp or a photoflood reflector, as can most of the smaller or larger bulbs. Make certain that the switch is in the off position when inserting the bulb. A searing burn results if the hand is on the bulb during a flash.

Our subject is a year-old, lively youngster, never in one place for long. Have him stand on a chair holding on to the back for support; this confines him to one spot. The chair should be placed a few feet from a background of your own choosing. Set up the camera on your tripod about five or six feet from the subject. Use the flash bulb in a reflector near the camera, slightly above and to one side of the camera, the location for soft modeling. This will mean that the flash bulb will be six feet away from the subject. Verichrome or Plenachrome film, whose speed rating is G. E. 32 or Weston 24, is in the camera. We are ready to compute the exposure for this set-up and capture on the film a good likeness of our "wild animal."

The manufacturers of flash bulbs supply data sheets which can be picked up from the literature rack in your dealer's store. On the sheet are charts similar to the one illustrated. As mentioned before, we find our exposure from known quantities. A correlation of film speed with the flash bulb used results in a *flash exposure guide number*, which remains constant as long as we continue to use this same film and same bulb. This flash exposure guide number is used to determine the proper lens aperture for a selected shutter speed. In this case we are using an "open flash," which is the equivalent of a 1/50 second shutter speed, because that is the duration of the flash. The lens aperture is found by dividing the guide number by the distance in feet from flash bulb to subject, six in this case. Our mathematical steps then are quite simple. The film rating is G. E. 32 or Weston 24. The bulb used is "Press 40." The exposure is to be an "open flash." Dividing 210 (the proper exposure guide number) by six (the distance in feet), we get f:32, the correct lens aperture for this home studio arrangement. Our exposure is therefore "open flash" at f:32. Result, perfect negative.

The procedure is to work in normal living room illumination, waiting for a good expression to come. In one hand we hold the cable release ready to make a bulb exposure. In the other we hold the reflector switch ready to flash the bulb while the lens is open. The room light will be so weak in comparison with the brilliant flash that the camera shutter can be open for a second or more without having an image register on the film.

It is a simple matter to compute flash exposures for faster films or for synchronizers by using this exposure guide method. The main point to remember is that the guide number is divided by the distance in feet from the flash bulb to the subject, regardless of the camera location, be it six feet or sixty feet from the subject.

As with so many things, the technical end can be solved. The human element rests entirely with the individual who operates. If you can flash the bulb at the instant of best expression, the flash will preserve that moment for you with the least waste of film.

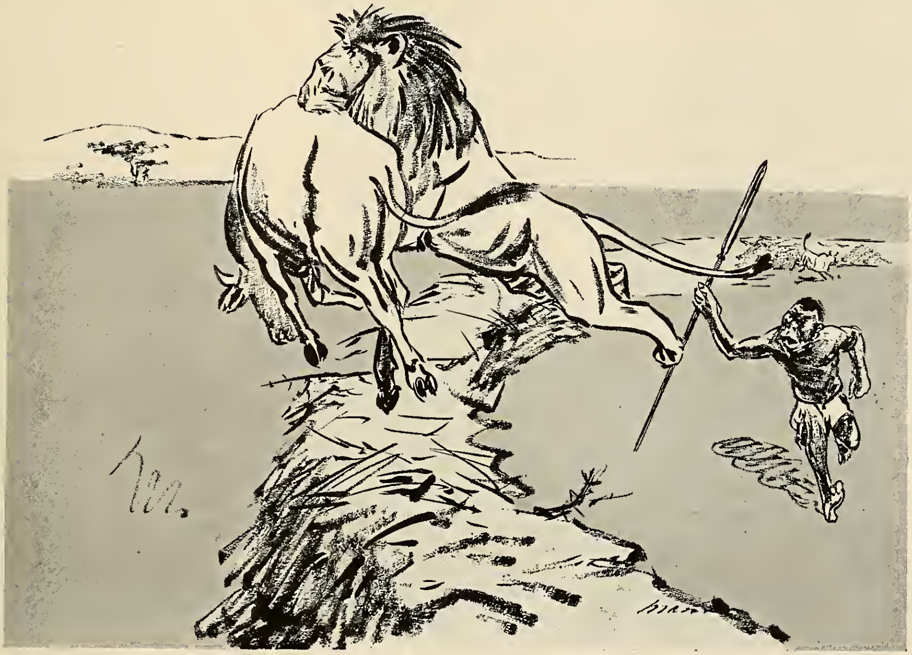
Flash bulbs may seem to be an expensive way to make photographs, but on close analysis the cost is not at all great when you can consistently produce the pictures.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be happy to try to answer them.—ED.

FLASH EXPOSURE GUIDE NUMBERS

Film Speed		Shutter Speed	"Press 40" Guide Number
G.E.	Weston		
32	24	Open Flash	210
		1/50 (synchronized)	210
		1/100 (synchronized)	180
100	64	Open Flash	340
		1/50 (synchronized)	340
		1/100 (synchronized)	290

STRENGTH OF LIONS



By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

THE event on which this cartoon is based took place in the Masai country of East Africa.[1] The natives here count their wealth and importance in their cattle, but these are a great temptation to the lions of the region. To protect their herds from these great cats the Africans build *bomas,* walls of thorn brush piled six or seven feet high, around their huts, thereby enclosing a space for their animals. When night falls the cattle are driven in and the entrance is closed by thorn brush like the rest of the *boma.* The herdsman and his cattle pass the hours of darkness behind this barbed entanglement. As a rule this keeps lions out, for they are afraid of getting thorns in their sensitive feet, but sometimes one of them, more daring and powerful than his fellows, makes off with an animal in spite of all precautions.

The man was sleeping inside his hut when he heard two lions outside his *boma.* The cattle huddled together on one side of the compound, terrified by the lions. Picking up his spear, the herdsman ran out between his stock and the danger; although one man with a spear is no match for a lion, the big cats can sometimes be driven off by a brave front. A splendid young lion leaped in over the barrier. The native could not bluff him and dared not close with him in unequal battle, but was forced to watch while the lion quickly killed a young animal, seized it in his jaws, and jumped back over the *boma.* Thus far, the story depends on the evidence of the Masai herdsman, but there was no other way for the lion to have carried off the bullock. The lion, his companion, and the victim were trailed the next morning by Dr. James L. Clark and Mr. William Leigh and were found two miles from the raided *boma.* The cow was larger than the lion and must have weighed nearly as much.

Other great cats perform feats of strength that are equally astonishing. A tiger is known to have swum across a river with a medium-size cow in its mouth. Another was watched while it dragged a half-grown buffalo up a steep river bank. This was the more difficult because the earth was soft and at each step the tiger sank deeply. Gaur are the largest of the cattle tribe, weighing up to a ton, yet a tiger dragged a large gaur more easily than several men could.

Leopards are only about a quarter of the weight of lions and tigers, but for their size they are quite as powerful. One, carrying in its mouth a ewe urial (a wild Indian sheep), sprang to the top of a ten-foot rock; and the sheep must have weighed nearly three-quarters as much as the cat. Another leopard, in Somaliland, leaped over the thorn fence around a native camp, seized a sheep, and jumped back out of the enclosure. Leopards often cache their kill in the crotch of a tree, out of reach of hyaenas and other scavengers. How they get animals weighing almost as much as themselves up in a tree is a puzzle, but such animals as the Indian swamp deer, partly-grown hartebeest, and a large reedbuck have been found high in trees.

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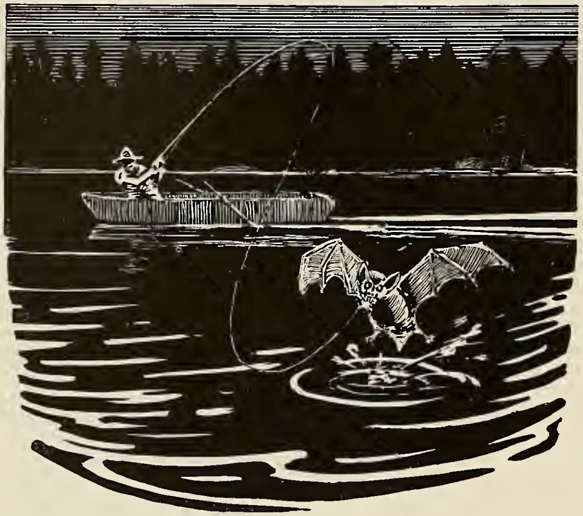
[1] *See* William R. Leigh's *Frontiers of Enchantment.* New York, 1938, Simon and Schuster.

Fishing for Bats



By C. R. Partik*

Last August 29, after work, I rowed out on Lac Long, near Ste. Agathe Des Monts, Quebec, to cast a festive fly to the big trout that had begun to come in to inspect their spawning grounds and were rising to nothing in particular.

Among my Numbers 10 to 16 there was nothing that roused their interest, and I knew that further effort would be wasted. It was one of those rare early autumn evenings for which the Laurentian hills are famous, and I let the breeze take my boat where it might. The sun had disappeared over the purple hills and the shadows had crept across the lake when the boat halted near the mouth of the creek.

Presently in the waning light I noticed what looked like a small minnow wriggling to the surface; it was the last stage in the metamorphosis of the May fly (Plectoptera). The little creature's back split open immediately and from it emerged the now complete insect, ready to take to the air within a few seconds when its wings were fully straight.

Then from nowhere in the semi-darkness appeared a bat. Without hesitation it dove to the surface of the water, cleverly picked up the newborn insect, and disappeared.

I happened to have in my fly box an excellent imitation of the May fly on a No. 10 hook. (This fly is known to fly fishing enthusiasts as Green Drake.) I put it on my leader, gave it a good coat of fat to make it float, and cast it about 20 feet from the boat.

Hardly had my artificial creation dropped on the water, and before I could twist my wrist enough to pull the fly under, the bat reappeared, picked it up, and was hooked. It made one or two attempts to get up into the air, but without success.

Slowly I retrieved my line to release the bat, being careful not to set the hook more than necessary; but by one last effort the creature freed itself and flew away.

I made several more casts in various directions. Every time the fly landed on the water, this or another bat was back. Only by close attention and immediate action could I prevent the creature from getting hooked. And I was reminded that, at least in this light, it would be wrong to say "as blind as a bat."

---

*Mr. C. R. PARTIK, a native of Quebec Province, lived for 20 years in the country north of the St. Lawrence River, where he says "the winters are really old-fashioned." He is one of the few persons who has succeeded in breeding and raising fishers (*Martes pennanti*).

Recently he has moved 50 miles south to be a little nearer civilization.—Ed.

LETTERS

Continued from page 97

for the sake of protecting ships intending to discharge or take on cargo. Ascension Island and St. Helena, both in the South Atlantic, are also famous places for waves of this type. On one or more occasions in the past, practically all ships in the harbor of St. Helena have been wrecked by the unforeseen onset of such rollers. It is now known, however, how long the barometric waves require to travel from the latitude of Ascension to that of St. Helena, and cable or radio information gives sufficient warning to enable vessels in port to seek the safety of the open sea.

* * *

Sirs:

In a review of *Birds of the Central Pacific* in the November 1944 issue of Natural History the reviewer brings up the old question as to how the fairy tern, and other birds, manage to make the latest capture when there are already several small fish in the bill.

A possible explanation has occurred to me. The fish are held in the bird's bill by pressure between the tongue and the upper mandible, thus allowing the lower mandible to open without losing any of the fish.

Edmund Selous in *A Birdwatcher in the Shetlands* offers a different explanation in the case of the puffin. I do not have the book with me here but, if I remember correctly, he suggested that each fish, as it is caught, is moved to the back of the bill and held there by the sharp edges of the bill slightly cutting into the fish.

With many thanks for your most interesting magazine,

J. D'Arch Northwood.

Okeechobee, Florida

* * *

Sirs:

Your magazine has come to me through the Maryland Academy of Sciences since 1939, and I find it very interesting.

I would like to ask you a question. Why is snow *white* rather than clear like ice? . . .

Beulah Mumma.

Waynesboro, Penna.

Snow is white because the light striking it is diffused by the many tiny crystals composing it. The individual crystals are transparent, but owing to their fineness they scatter the light when taken in the aggregate. For the same reason, clear ice becomes white when it is shaved. Similarly, glass or clear rock-candy when powdered becomes white like sugar or snow.

Red or pink snow of the Arctic regions is a different matter. The color is due to a tiny alga that lives on the surface of the snow.

Clyde Fisher.

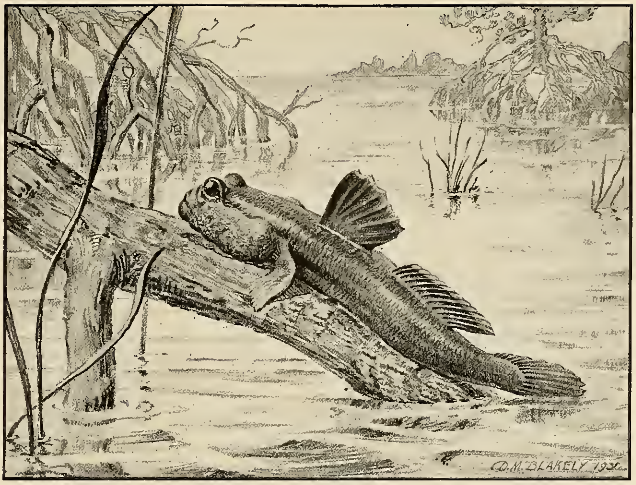
* * *

Sirs:

The following quotation is from a letter from my brother, who is stationed in Liberia. I would be very grateful if you could identify the fish he describes and give me further information concerning it.

"Alighting from the canoe at a native village, we saw things move on the bank. I thought they were lizards, but Wray looked closer and said they were something he had seen in movies taken in Australia. . . . They varied from two to five inches in length and were shaped like a wedge. They had two reddish eyes set on a short stem above the head and two limbs more like fins than anything else, just behind the head. They used these as legs and hopped toad-fashion or crawled slowly. We couldn't catch any, because they all moved under the bank or into the water, but they wouldn't stay in the water long. We saw them quite close up, and Wray is sure they look like what he saw in the movies. Maybe you can find out for me what they are and what they are called. . . ."

James L. Jowett.
Norristown, Penna.



▲ The Mudskipper, *Periophthalmus*, on mangrove roots. (See letter at left)

We are informed by the American Museum's Department of Fishes and Aquatic Biology that Mr. Jowett's brother in Liberia was observing the Mudskipper, *Periophthalmus*, probably *Periophthalmus koelreuteri* (Pallas). This fish is one of the Gobies and is famous for leaving the water and walking or hopping about on sand or mud in pursuit of food. It is found in tropical waters in the eastern Atlantic (West Africa) and the Indo-Pacific.

The late J. R. Norman in his *A History of Fishes,* page 79, says: "It chases its insect prey among weeds and rocks, and on land is quite as agile as many lizards. The pectoral fins are specially modified in relation to this habit, each being attached at the end of a kind of muscular arm, which can be moved backwards and forwards and is used exactly like a limb. Among other structural peculiarities designed to assist its progression on land, the low anal fin and the stout lower rays of the caudal may be noticed. Dr. Regan writes: 'When walking on the mud each step is accomplished by a forward movement of both pectoral fins, which are then put on the ground and draw the rest of the body after them; these steps are repeated rapidly, and as each results in an advance of about half an inch, very fair progress is made; the pelvic fins support the body during the turning forward of the pectorals. But, as their name implies, the Mudskippers often leap along the mud, or from one stone to another; short jumps may be accomplished by the action of the pectoral fins alone, but longer ones, which may be as much as a yard long, are made by a stroke of the tail. This is their way of getting along when they are in a hurry, and they may often be seen playing on the mud, jumping about in chase of each other.' "—Ed.

* * *

Sirs:

May I express my appreciation for the articles on "Homes of the World" by Dr. Shapiro. This series alone is worth many times the annual membership dues.

Ina Corinne Brown,
Professor of Social Anthropology.
Scarritt College for Christian Workers
Nashville, Tenn.

* * *

Sirs:

. . . I enjoy your Magazine more and more all the time. Everything about it is a joy—the pictures so beautiful, the paper so fine . . .

(Mrs.) J. Warren Cutler.
Rochester, New York

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

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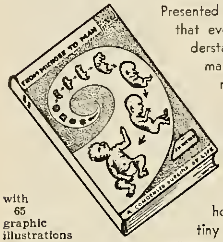

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have long needed the information brought to light by its author. It cannot, however, be said that they will receive with equal enthusiasm the cumbersome presentation of the record. Unfortunately the author apparently had little or no use for the refinements of archaeological technique. At least he betrayed no concern with them so far as the reading of this book reveals. Despite those defects, it will be indispensable to scholars.

H. L. S.

THE MURMUR OF WINGS

- - - - - - - by Leonard Dubkin

Whittlesey House, McGraw-Hill Book Co., $2.50
14 illus., 167 pages

OF books on birds there seems never a scarcity, nor are they all cast in one mold. Many are meant to teach the novice to call each species by its proper name. But the impact of wings on human personality brings out many another response.

Leonard Dubkin dreamed from boyhood of writing a book about birds. His schoolmate Berny felt confident at first of making his fortune out of bird study. The need of paid employment, however, pushed Leonard into journalism and publicity, while Berny forsook birds for Hollywood, where subconsciously he put birds and more birds into films. Leonard continued to watch his favorites from Chicago windows and bridges.

Psychoanalysis might help us to understand the book that Leonard Dubkin finally brought forth. Yet it is amusing without that effort. If one wishes to learn more about birds, even those of a great city like Chicago, he need not try here; but if he likes to look into the minds of people who are attracted by birds, then there is good fun packed between its covers.

The birds discussed are those that cannot escape notice: pigeons, gulls, grackles, starlings, and sparrows. Others get scant mention. People's reactions to birds, or their attitude toward their neighbors who are positively ornithotropic, are wittily dissected. The confirmed "bird lover" who writes indignant letters to the newspapers, or who tempts birds to linger overlong at his northern feeding station, is the person Dubkin likes least. He has more sympathy for the schoolboys who stamp the life out of a crow because they thought it laughed at them. Strangely enough, the author has overlooked the professional ornithologists, whose acquaintance he disdains. If he contemplated another book he might do well to extend his studies to that neglected corner of his field.

JAMES P. CHAPIN.

THE WORLD AND MAN AS SCIENCE SEES THEM

- - Edited by Forest Ray Moulton

Garden City Publishing Company, $1.98
178 illus., 533 pages

THIS is a Garden City reprint of the book originally published by the University of Chicago Press in 1937. The passage of a few years has not made the work out-of-date, and it is a pleasure again to recommend it and to hope that this issue will reach a still wider audience.

The book is a compendium of science for the intelligent layman. I know of no better or more authoritative work in its important and useful field. A certain unevenness in style is the inevitable outcome of the fact that the work is so authoritative, each of the eleven chapters being written by a specialist in one particular branch of science. Indeed, the different methods of exposition add a certain pleasing variety that tends to sustain interest.

The subjects covered are astronomy, historical geology, atomic physics, chemistry, and various aspects of biology; the nature and origin of life, plant evolution and reproduction, invertebrate behavior, vertebrate evolution, physiology, microbiology, and racial anthropology. The reader who wishes to dip into the volume

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thus has a fascinating choice of topics, although it must be admitted that a really well-rounded treatment of the subject stated in the title is not achieved. For instance that part of physics most truly pertinent to our daily lives is omitted (a fault of most recent popularizations of this science), and so are such highly important aspects of the world and man as heredity, psychology, and social anthropology. In contrast, such relatively abstruse or remote problems as wave mechanics, the evolution of sex in plants, and learning in protozoans are treated in some detail.

G. G. S.

THE GREEN CONTINENT

A Comprehensive View of Latin America

By Its Leading Writers

- - Selected and Edited by Germán Arciniegas

Translated from the Spanish and Portuguese by Harriet de Onís and Others

Alfred A. Knopf, $3.50, 533 pages

AGAINST the general "good will" background of the moment, the book *The Green Continent*, skillfully edited and co-ordinated by Germán Arciniegas, and translated by Harriet de Onís and others, stands out like a true oasis, not a mirage, in the desert lands of mutual hemispheric ignorance. Here in some 500 pages are presented selections from the best writings of 33 authors, all citizens of the variegated southern nations too often indiscriminately lumped under the phrase "Latin America." In these pages, none of which were written for any immediate or propagandistic purpose, there is presented a sample, in vivid English, of the rich and complex physical and intellectual worlds of Mexico, Central America, and South America as seen and interpreted by their own people.

For the North American reader who, like the reviewer, is no linguist, but wishes to know what our southern neighbors actually are like, here is an introductory key. "Landscape and the Man" gives a firsthand view of the variant southern lands, their incredible beauties and rigors; "The March of Time," the Colonial background; "Bronzes and Marbles," the continuing fight for freedom, physical and intellectual; "The Cities," the background, charm, and modern significance of Rio de Janeiro, Buenos Aires, Mexico City, Lima, and Cartagena; and, "The Color of Life," the human atmosphere of racially and culturally complex but vitally important civilizations. Each section includes several authors, who write intimately on the basis of intimate knowledge. Each deals with geography and the past in such a way that the human present stands forth in clarity and the future assumes vital challenge. We can only hope that some of the translations of North American literature now being made in Spanish and Portuguese share in part the vividness and reality of the book under review.

WM. DUNCAN STRONG.

First . . .

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LIFE ON A SUNFLOWER LEAF

Continued from page 119

away, so small and so quick on the wing that she seems to disappear in the air.

After stocking the burrow with 15 to 20 or more aphids, she lays an egg among them. Then she walls off that portion of her burrow with bits of pith and begins to provision a new compartment above the first. So she continues to supply as many as six or eight separate cells in a single stem. If we were to split a stem containing a nest of *Stigmius*, it is likely we would find the larva on the ground floor full-grown while the upper story tenant was not yet hatched from the egg. Sometimes one or two rooms will be deserted and the aphid stock dried and brown, with no sign of egg or larva. Apparently the mother wasp simply failed to lay an egg.

The larvae are at first curled, gray, covered with white spots. After the larder has been emptied, the larva straightens to become the bright yellow prepupa and later the yellow pupa. It gradually turns black before the emergence of the black, winged adult.

Unlike the subversive tactics of the parasite or the kidnapping technique of *Stigmius* are the frankly predatory activities of the larvae of a syrphid fly and the aphid lions or larvae of lacewings, as well as both larvae and adults of ladybird beetles.

The syrphids, also known as flower flies and hover flies, have peculiar children. They are legless larvae, greenish marked with brown. The hind part of the body is broad, while the fore part is slender, tapering, and extensible. As they crawl slowly about on the leaf, they wave the front part of the body from side to side, stretching it out and again retracting it. When one of them encounters an aphid, it grasps the prey with its mouth hooks and, extending its forepart upward, holds aloft the hapless aphid. The aphid may struggle, waving its legs in the air, but to no avail, for it cannot reach the leaf surface or anything else. While held thus in the air the aphid is drained of its body juices and soft parts by the syrphid larva. Then the dry remains are cast away, and a new victim is sought.

When mature, the syrphid larva pupates in a hard brown puparium (the last larval skin) firmly attached to the sunflower stem or hidden in a curl of the leaf. Usually in due course a yellow and black syrphid fly emerges. Sometimes, instead of the expected fly, a red and black ichneumonid wasp cuts its way out. Few, indeed, are the insect species free from the attacks of such parasites.

"Golden eyes" and "green lacewing" are common names for *Chrysopa*, and these names are appropriate to the dainty beauty of the adult, but aphid lion is the most fitting name for the larva. On the sunflower leaf that we have been observing, there are no lacewing eggs, but they may be found elsewhere on the plant. Each tiny white egg is fixed to the top of a hair-thin stalk nearly half an inch high. As each little pole-sitter hatches, it descends the stalk and sets out in search of prey. Aphid lions have disproportionately huge jaws and outspread legs, and the gray body tapers to the rear. Aphids so unfortunate as to be in the path of their prowling are quickly seized and sucked dry. When fully grown, the tiny brute rolls up in a spherical, tightly spun, silken cocoon which resembles a rather dull pearl. From the resting pupal stage in this cocoon the fragile, slender, green, lacy-winged adult emerges. The adults take no food; they rest by day beneath leaves and flutter about in the twilight and at night. They are possessed of a foul odor which may help to protect them from their enemies. Some species of green lacewings, however, appear to lack odor entirely.

But probably the most important of the aphid enemies are the ladybird beetles or ladybugs. So much has been written of these interesting insects that we need describe them only briefly here. Commonest on the sunflower leaf is the convergent ladybird beetle (*Hippodamia convergens* Guérin). The adult is mostly red with small black spots. On the black prothorax are a pair of convergent white dashes which give it its name. In a general way the alligator-shaped larvae resemble aphid lions, but they are much more strikingly colored in their black dress spotted with orange. Unlike the lacewing, both adults and larvae feed on aphids, and they chew them up instead of merely sucking out the juices. It is said that one larva may eat as many as 25 aphids in one day, and one of its parents may consume 55. The eggs, like tiny, fat, yellow cigars standing on end, are laid in small clusters on the leaves and stem of our plant.

Adults of several other species of ladybird beetles are frequently seen on our plant and probably eat a small share of the aphids. A few larvae as well as adults of a species of *Scymnus* are found occasionally on the sunflower leaf. The adults are small blackish ladybird beetles. The larvae, however, are conspicuous among green aphids, for they are covered with long filaments of white wax. These larvae are ordinarily found among groups of mealy bugs, upon which they feed. Since mealy bugs are likewise covered with filaments of white wax, *Scymnus* larvae are very inconspicuous among them. There is no doubt, however, that the larvae on our plant were feeding on sunflower aphids.

As autumn approaches, our leaf becomes darker. Patches along its edges turn brown and die, and other parts where the aphids have been feeding curl somewhat. Finally the whole leaf becomes yellowish, then brown, as it dies.

Clearly the aphid colony is the center of activity on the sunflower leaf. Other colonies at other times are harassed by different parasites and predators not observed on this leaf. Yet unwilling hosts and defenseless prey though they be, they maintain the colony until cool weather and the gradual death of the plant, now in seed, drive away or kill the remaining individuals. Each aphid is a helpless atom; yet the colony is strong, for it fights back by simply producing more and more young. In the long run the victory is often the aphids', for some species become so abundant as to damage severely man's cherished crops.

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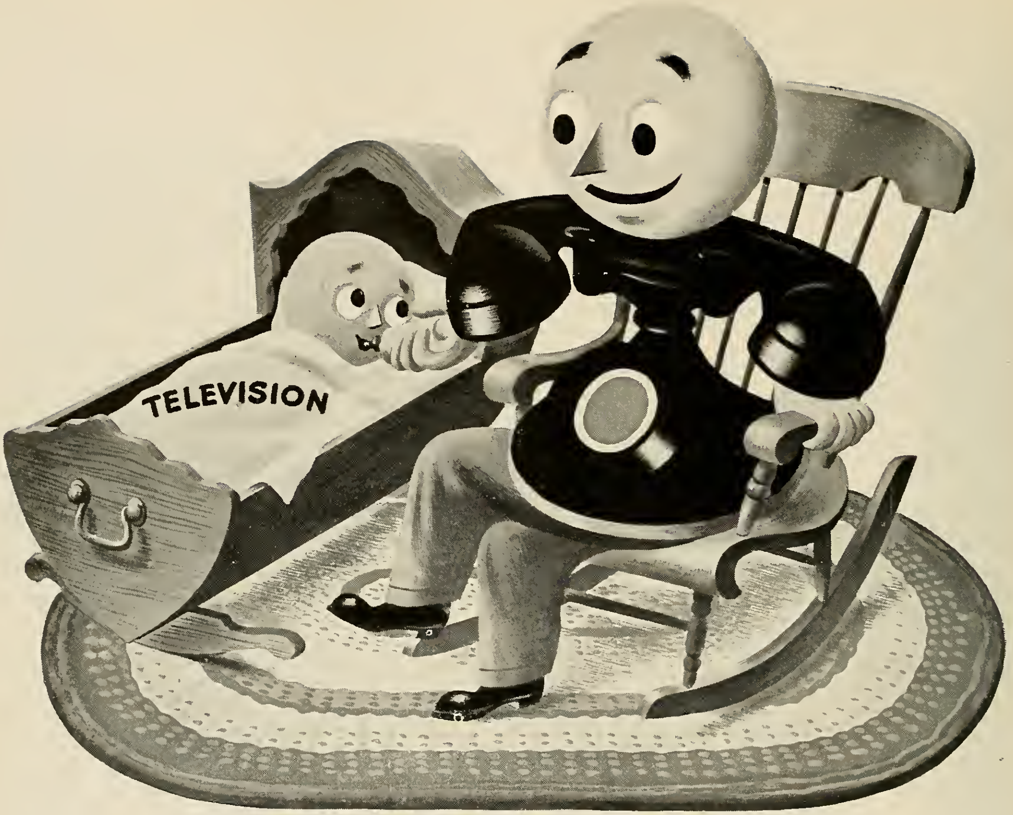

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VOLUME LIV—No. 4 * * * * **APRIL, 1945**

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THE COVER THIS MONTH

The Kodachrome of a Red Maple blossom, *Acer rubrum* (Linn.), that decorates this issue was taken by the Reverend J. R. Swain of Bridgeport, Connecticut. It illustrates the beauty that is offered in abundance by a common tree yet passed unappreciated by most people unless they take a little trouble to examine it.

The enlargement on the cover shows the flowers at approximately nine times natural size. Like all other maples except the Box Elder, this tree has both male and female flowers on the same tree. The picture shows three clusters of male flowers. The double-celled pollen-sacs (anthers) are clearly evident on the ends of the rodlike filaments.

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BLACK WIDOW: America's Most Poisonous Spider

- - - by Raymond W. Thorpe and Weldon D. Woodson

University of North Carolina Press, $3.00
36 illustrations, 222 pages

THE spiders of the genus *Latrodectus* have long been regarded as poisonous by many different peoples, who have given them such picturesque names as "malmignatte," "karakurt," "red-back spider," and "black widow." All these creatures, the majority of which are gayly colored in shining black and splashed with red, have a neurotoxic venom that is capable of causing grave systemic symptoms in man and other warm-blooded animals. The victim usually experiences acute pains centered chiefly in the abdominal region, which may become excruciating within an hour or two and remain so for twelve or more hours before they gradually abate. According to Dr. Bogen, the best treatment is the intravenous injection of gluconate, which largely precludes the need for the serum which has become available recently. The authors list 1291 cases of black widow bite from the United States during more than two centuries and report that 55 resulted fatally. There has been little question of the venomous nature of these spiders for more than 20 years, but many of our data still lack exactness.

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The principal American species is *Latrodectus mactans,* our black widow, hour-glass or shoe-button spider, which is now known to occur in every State and in various Canadian Provinces. Hardly known to the layman until after 1934, this colorful spider quickly seized the imagination of a credulous and undiscriminating public and gained a reputation for deadliness that is largely unjustified. The authors have brought together an imposing number of citations and references on this spider, but in limiting themselves to the United States they have missed much lively and important information on this same species in South America. The best part of the book is the verbatim reporting of such investigators as Dr. Emil Bogen, who should be credited with much of the pertinent medical research on the spider.

The early chapters on "Spider Lore and Legend" and "Tarantism" will be found most interesting and will to some extent compensate for the latter ones which are dull and repetitious. The importance of this spider and its poisonous bite have been greatly overemphasized.

W. J. GERTSCH.

THE TEN GRANDMOTHERS

- - - - - - - - by Alice Marriott

Norman: University of Oklahoma Press, $3.00, 306 pages

THIS is a book about the Kiowas, a plains tribe of Indians, whose territory is in what is now western Oklahoma around and to the north of the Wichita Mountains. The Ten Grandmothers are ten medicine bundles, sacred symbols of power. Although dating from the dim and distant past, the bundles themselves

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still exist,—as sacred and as valued as ever. They were tribal safeguards, protection against evil. From them the Indian believed he received power, as he conceived the word. As Chief Sitting Bear said to his sons, "You've got to have power working with you all your life, or everything you do will go wrong."

Beginning nearly one hundred years ago with the war party against the Utes in 1847, down to the war party that set out in uniform to fight the Germans and the Japanese in 1942, we are given a clear and convincing word picture of these people,—from a primitive culture to assimilation into the white man's way of life. The interesting and carefully prepared Kiowa calendars in the back of the book carry the record back to 1826. The running story is essentially the oral tradition of the Kiowas, given to the author by elder informants of the tribe. It has been set down with fine literary skill in all its artistic simplicity. The writing has a strong Indian flavor, reflecting real understanding. The story is full of beautiful figures of speech, often translations of Indian thought, always poetic prose.

This book is number twenty-six in the Civilization of the American Indian Series, and a worthy one. The author, Alice Marriott is a trained ethnologist. She has served as specialist in the Division of Indian Arts and Crafts for the Department of the Interior, and as a field research fellow for the Laboratory of Anthropology at Santa Fe, and for the Department of Anthropology of the University of Oklahoma. In addition to two summers residence among the Kiowas, she has devoted more than eight years to research and to writing this story.

Te Ata.

LOOK TO THE FRONTIERS

- - - - - - - by Roderick Peattie

Harper and Bros., $3.00
246 pages, 22 maps and diagrams

MR. PEATTIE rather aptly characterizes his own book when he speaks of "planners and their compact little books which are flooding our bookstores." They are, he goes on to add, if "not definitive," at any rate "thought provoking." Definitive is certainly not the word for Mr. Peattie, and the thoughts he provoked in this reader were not entirely in agreement with his own.

His aim, the author explains, is to examine the geographic foundations to a lasting peace. To this end he discusses regionalism as the natural outgrowth of geographic circumstances. Nationalism comes in for analysis and, although he recognizes its value, he deplores the extremities to which it has been carried. Modern wars, says Mr. Peattie, are the result of nationalistic competition and are frequently fought over boundaries. Remove these boundary problems and much of the tension is relieved. Boundaries of various kinds—mountains, strand lines, rivers, and political agreements—are often unsatisfactory and all too infrequently solve the problems of national ambition and expansion. Mr. Peattie would substitute a series of zonal boundaries consisting of small buffer states with international communications neutralized, thus weakening the political significance of the boundary line and relaxing the pressures that lead to war.

The future of transportation by air Mr. Peattie sees as likely to engender additional troubles unless we take steps to internationalize air sites and guarantee the freedom of the skies.

In spite of his inclination to set up international mechanisms, he is not prepared to advocate a world state. Instead, he proposes a series of federations based on land continuity and community of interests. Within such frameworks, economic communication might be facilitated and boundary concepts weakened to the strengthening of peace.

H. L. Shapiro.

BURBANK AMONG THE INDIANS

- - - - - - - - - by E. A. Burbank
as told by Ernest Royce

The Caxton Printers, Caldwell, Idaho,
$5.00, 232 pages

BURBANK, or "Many Brushes," as the Indians called him, made many portraits of Indians, mostly during the closing years of the last century. He was an artist of talent, as attested by the 56 paintings that are reproduced in this book. The frontispiece is of the Apache Chief Geronimo, and is in color. This makes the reader wish that all the rest could have been in color. The illustrations are a most valuable feature of the volume.

The book is somewhat marred by careless slips in editing and proofreading. On the jacket the story is presented as told *to* Ernest Royce, on the cover *by* him: In the publisher's blurb on the jacket an unfortunate slip occurs in crediting Charles F. Lummis as the author of the anthropological classic, *The Delight Makers,* which was really written by Adolf F. Bandelier. Scattered through the book are a number of misspelled words and inconsistencies in spelling. The name for paper-bread (piki) is sometimes spelled "pike" and at other times "peki,"—both incorrect. The Smithsonian Institution is always referred to in this book as the Smithsonian Institute.

Burbank's portrait of Rain-in-the-face is marked "Ft. Yates, S. Dak.," but Ft. Yates is in North Dakota. The artist's hearsay story of the killing of Sitting Bull is somewhat at variance with the most authentic accounts, and, in his story of Custer's last fight, he admits that all he could get out of one of his best informants, who had participated in the fight and had promised to tell him all about it, was "Heap big fight. Heap dust."

According to his own count, Burbank lived and worked among 128 North American Indian tribes. During the time he was painting, he set down many a revealing episode in connection with his work among the Indians. He had abundant opportunity to learn the Red Man's point of view on many subjects. He felt that Chief Joseph, the Nez Percé, was the greatest Indian he ever knew. His personal experiences with a wide range of important Indians makes fascinating reading.

Te Ata and Clyde Fisher.

SPORT FISHING IN HAWAII

- - - - - - by Edward Y. Hosaka

Bonds, 1360 Koko Head Avenue, Honolulu, T. H., $2.75, 198 pages, 114 drawings by the author, 34 photographs

MR. HOSAKA, as the reviewer discovered while his guest on fishing excursions to Hawaiian beaches, has a knowledge of this sport that must rival that of the early island natives. The first half of his handbook discusses all phases of shore fishing: kinds of hooks, leaders, knots, and lines; making a casting pole, securing bait, etc. There are also chapters on the less usual methods of fishing such as torch fishing, spearing and netting, as well as on trolling and deep-sea fishing. A map shows the best fishing grounds, and there are abundant illustrations.

Hosaka, while traveling among the islands as botanist and agronomist for the Bishop Museum and other institutions, has been able to fish in a variety of places and to converse with Hawaiians and with the half dozen other peoples comprising the bulk of the secondary population of these islands. In this way he has gathered much interesting lore that is here recorded for the first time. His chapter on methods of cooking fish (or eating them raw!) will be read with profit by even the most experienced "stateside" cook.

In the second half of the book the 73 most important game fishes of the Hawaiian Islands are figured and described. A few celebrated in song or story rather than for sport, such as the humuhumunukunukuapuaa, are permitted to go drifting by with the others. There is a simple key that will be of general use, since most of these species are of wide distribution in warm seas. The habits of many of the fish are discussed in remarkable detail, which will be appreciated by scientists as well as fishers. Hosaka is expert at the fascinating sport of swimming and diving along the reefs well offshore to spear fish. Since goggles are worn and the water is very clear, much can be learned of fish in this way, perhaps too much if a barracuda or man-eating shark, both not uncommon, is encountered.

Sport Fishing in Hawaii will be of interest to fishermen everywhere, particularly to shore fishermen. It can be especially recommended for servicemen on South Pacific islands, to many of whom fishing is one of few available diversions.

Dean Amadon.

TEMPO AND MODE IN EVOLUTION

- - - - by George Gaylord Simpson

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gist has accumulated a great deal of evidence. A study of evolutionary rates under natural conditions ("tempo") is one of these topics; the genetical and morphological bases and consequences of various forms of living ("mode") is the other.

In his treatment of these topics Simpson has succeeded not only in summarizing and making available much of the results of the widely scattered and rather technical paleontological literature, but also in correlating these facts and in giving them a new meaning. It has been claimed sometimes that paleontology was more closely akin to history or archaeology than to the other subdivisions of biology. This is true, of course, only as far as the working methods are concerned. In all three fields a reconstruction of past events is attempted on the basis of incomplete evidence. It needs an original and imaginative thinker like Simpson to do such an interpretive job satisfactorily.

Whenever possible the author correlates the paleontological evidence with facts derived from neighboring fields, such as ecology and genetics. He finds no conflict between paleontology and the results of recent genetic research. Special attention is given to the phenomena that have given rise to such terms as "orthogenesis," "explosive evolution," and "preadaptation." Some of the unsolved problems of evolution are brought in sharp focus. The findings of each section are summarized concisely.

The author's hope that his study might suggest "new ways of looking at facts and new sorts of facts to look for" will surely be fulfilled. It has opened new worlds to the reviewer. A far-reaching influence of Simpson's book on evolutionary thought and on the field of paleontology can be predicted. E. MAYR.

TELESCOPES AND ACCESSORIES

- - - - - by George Z. Dimitroff and James G. Baker

The Blakiston Company, $2.50, 309 pages

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ments and their uses. It explains not only the fundamental principles of the tools of the astronomer that have been in use for generations, but also the instruments developed in recent years.

Students of the physical sciences naturally are eager to know how the astronomer has discovered the facts about the celestial bodies, and such questions are answered here in a non-mathematical treatment of the various subjects. The book will prove of especial interest to amateur astronomers and amateur telescopemakers as well as teachers of astronomy.

There is a brief but practical discussion of light as a "tool," with attention to light waves, color, polarized light, reflection, refraction, and quanta. The chapter on visual telescopes considers the human eye as an optical instrument, the various types of refracting and reflecting telescopes, and the different kinds of eyepieces. A brief account of the history and development of the photographic process, or the storing of light, with especial reference to its use in astronomy, is given. Then follows a chapter on photographic telescopes, including the Schmidt camera, the Schwarzschild reflector, the Ritchey-Chrétien reflector; and also the finest lenses, including the photographic doublet, the Cooke triplet, the Ross lens, and the Zeiss Biotar. Here, however, I missed the Apochromatic three-lens objective.

The history and devolpment of the science of spectroscopy from Newton's classical observation down to the complicated spectrographs of the present day are described together with explanations of the revelations of these instruments. Photometers, the spectroheliograph, the spectrohelioscope, the spectroheliokinematograph, the coronagraph, and other instruments of the astronomer's workshop are clearly explained. Finally there is a fascinating chapter on building some of the great telescopes.

The abundant excellent illustrations throughout the book add much to its value.

Clyde Fisher.

ABC'S IN VICTORY GARDENING

Success for Victory Gardeners is considerably more probable if they will observe five simple rules or principles which have proved helpful both to old hands and to inexperienced gardeners in recent years, according to Victory Garden Headquarters at the U. S. Department of Agriculture.

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5. Insure against drought injury—with provision for irrigation or watering if possible, and with organic matter in the soil and mulches on the surface which hold moisture in the soil, whether it comes from rains or from watering.

A STORY OUTLINE OF EVOLUTION

- - - - - - by Charles W. Grimes

Bruce Humphries, Inc., Boston, $2.00
244 pages

This book is devoted to the thesis that the results of scientific research are compatible with theism and that evolution, accepted as a proven fact, is to be interpreted as God's method of creation. That such an exposition is useful and has an audience is attested by reissue of the work after seven years and by favorable remarks on the first edition by religious educators.

The author's aim is commendable. The sincerity of his desire to present science fairly and without bias is unquestionable. His piety is beyond criticism by scientist or theologian. It is, then, with regret that recommendation of the book must be withheld. The author has so completely failed to present the facts as now known and to understand the modern theory of evolution that his account is, at times, little above the level of travesty. The curly hair of the Negro makes him immune to sunstroke; ostracoderms had two or three sets of jaws, and their armor became the feathers of birds and the skin of mammals; flying crocodiles prepared the way for birds; mammals suck in the memories, instincts, traditions, and experience of the species from their mother's milk; mother-love is the most potent force in the world; each step in the development of the human embryo shows where one ancestor stopped and the next, better equipped, began—these are only a few random examples of the hundreds of statements that are rather a burlesque than a popularization of present scientific knowledge.

That the author does not understand his subject and that theologians do turn to such a poor source for knowledge of evolution are perhaps indictments as much of the students of evolution as of this unfortunate book.

G. G. Simpson.

FLOWERS IN BRITAIN

- - - - - - - - by L. J. F. Brimble

Macmillan and Co., $4.50
393 pages, 67 figures, 17 colored plates

Here is a most attractive book for the layman, which assumes no technical knowledge of botany. A wealth of information about plants is here gathered together and logically arranged,—always from the beginner's point of view. Some 40 pages are devoted to a general discussion of the flowering plants, of flowers, and of the classification of plants. The main part of the book,—more than 350 pages,—consists of descriptions of plants by families. Under each family they are grouped as wild plants, cultivated plants, herbs, economic plants, and weeds in case there are unwanted members.

The book is copiously illustrated both by black and white cuts and colored plates. The former consist of clear, helpful drawings, and excellent photographic illustrations, while the latter are fine drawings in color. Altogether there are seventeen colored plates, each with eight or ten flowers, —about 150 flowers in color, each surprisingly good in spite of its small size. These colored plates show the distinctive features of the plants whether it be the inflorescence, leaf-arrangement, fruit, or seed,—and only common names are used.

Scattered through the text are scores of well-selected quotations, mostly poetic, from the great writers, which add much to the beauty and interest of the treatment. Apparently all the flowers of English literature have been included. At least this reviewer did not miss any. As is well known, a goodly number of these have been introduced intentionally or accidentally into America.

The author is a Fellow of the Linnaean Society of London, joint editor of the English magazine *Nature*, and formerly Lecturer in the Universities of Glasgow and Manchester. The book will appeal to field naturalists who are interested in plants, to gardeners, and to horticulturalists in general.

Clyde Fisher.

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RACCOONS we have known

By WILLIAM H. CARR

Director of the Bear Mountain Trailside Museums, Associate Curator, The American Museum of Natural History

It was the girls' own fault to begin with, and not the raccoons'. If the children had not left chocolate bars lying about their tent platform, the raid would never have occurred. Toward midnight, a very large raccoon mother, accompanied by several infants, invaded the campers' quarters and caused no end of confusion. There were eight girls present, and one of them must have concealed some edibles beneath her mattress, for the old 'coon actually walked across her blankets, waking her up and causing her to shriek long and loudly for help. Her cries brought a Park Patrolman, the Camp Director, a number of Councilors, and, in addition, it awakened some 150 children in adjoining tents and cabins. The disturbed raccoons stalked away into the darkness but were identified by several of the girls before they disappeared.

Incidents of this sort are not unfamiliar in the 42,000-acre Bear Mountain-Harriman State Park preserve. Many raccoons have learned that camp kitchens, refuse collections, and candy boxes are available during summer months when 6000 children in 92 different camps arrive for their woodland vacations. As a consequence, many hundreds of city dwelling children and others have become familiar with the animal that wears a black mask across its eyes.

At the near-by Trailside Museums, we have exhibited raccoons for years. Many and varied are the experiences we have had with these intelligent American animals, in captivity and out. We have had raccoons that showed real antagonism toward one of our staff yet accepted all others with pleasure and would play with us literally by the hour. The principal actor among them was a large, yellowish animal which remained tame for more than a year.

The first time the unfortunate boy noticed the female 'coon's strange resentment was when he unsuspectingly entered the cage one day for the purpose of cleaning it. He had no sooner closed the door from the inside than

All photos from Palisades Interstate Park Commission by Harold K. Whitford

◄ "THE CONTENTED HOUR" at the Bear Mountain Trailside Museums. A sound recording has been made of the animals when feeding from the bottle. Anyone who has raised a 'coon from infancy may recognize it, but no one else

▼ HAVING no mother of their own to nurse them, these little 'coons were quickly introduced to the cat in a near-by garage. And the cat apparently welcomed the opportunity to become their "service station" the 'coon was upon him, a growling, biting fury. Before the boy could escape, he had received at least two dozen bites upon his legs and hands. Thereafter, whenever he approached the cage, the raccoon would rush at the wire and try to attack him, with ears flattened and entire body trembling with rage. Yet the animal was so tame that she would permit other members of our group to place their fingers in her mouth and would behave like a puppy under these circumstances. As far as we know, the boy who aroused her anger had never abused her in any way whatsoever. Events of this kind are difficult to explain.

In the course of providing room and board for raccoons, we have had a number of escapes from our cages. Quite often they were animals that had been kept for a number of years, had been handled like the others, and were equally tame. On escaping, particularly at night, some would rush off into the woods and never appear again. Others would remain in the vicinity until recaptured. One in particular sat upon his cage roof all night and morning until we saw him and lured him back home with the aid of a dry roll.

The difference in sex and the time of year have had little to do with this discrepancy in behavior. Happenings of this sort serve to emphasize the fact that raccoons, together with many other animals, are often individualists. Certain forms of behavior seldom apply to all individuals in equal degree. It is this variation that makes the study and care of animals interesting, for one is constantly on the alert and learns to expect the unexpected. One who has lived and worked with animals seldom makes glib, generalized statements concerning their habits and behavior patterns, unless he has a story to sell and has difficulty marketing it.

On several occasions, with one hand filled with the raccoons' food trays and the other engaged in opening the cage door, we have had animals slip out and away. Some would instantly climb to the very top of high trees near-by, while others would dash through the woods, apparently with no thought of climbing. They seemed to rely entirely upon their speed to effect an escape. One such animal, upon escaping, was pursued through the woods, over cliffs and hills, for more than a mile before it was finally captured. At no time did this animal show the slightest inclination to scramble up available tree trunks.

The behavior of captive parent raccoons toward their young has always been of importance to us, for complications frequently arise to test our ingenuity. When Ginger, our tame raccoon mother, commenced to lose interest in her three very recent offspring, we were faced with an emergency. We had raised infant 'coons with medicine droppers and small nursing bottles, but these squalling babies were just too much. We were at the time responsible for three dependent young woodchucks, six gray squirrels with their eyes just opened, two kit beavers, and a tiny gray fox, all in the Trailside nursery. Soon there would be a pair of Virginia Deer fawns to bring up, to say nothing of several demanding bear cubs. The milk bill was too high as it was, and our hands were full.

Every day that went by demonstrated that Ginger was no proper parent. She dragged her young ones about the large cage by the tender scruffs of their necks. Despite their wails of protest, she would climb the wire with their limp forms hanging from her mouth. She pushed them through the small entrance hole of one of her nest boxes, only to reappear with them the next moment and continue her perambulations. When the little 'coons tried to feed, the mother would become impatient and shake them off. Something had to be done at once if the offspring were to survive.

We found the answer to our problem in the feline presence of Gloria, the friendly and intelligent cat which occupied a place of honor on the staff of our Bear Mountain State Park Garage. Gloria had just lost her kittens and was still looking for them when we arrived with the three little 'coons. We prepared a box, lined with an old sweater, in the warm paint room of the garage and placed the hungry 'coons within. Then we sought the bereaved cat, picked her up, and brought her to the nest box. Without hesitation she stepped daintily into the container, very carefully inspected the strangers and then, when one of them whimpered, she commenced to lick its face with her rough, warm tongue. She lay down in a corner of the box, and the little ones quickly struggled over and climbed upon her. She offered no resistance whatever, and soon the searching 'coons discovered the source of liquid nourishment that their rightful mother had all but denied them. From this point, all was well. Gloria became a perfect foster parent, faithful, affectionate, and gentle.

Eventually, the 'coons reached the stage where they commenced to wander abroad. At night they would investigate the precincts of the paint shop, and the watchman observed that Gloria would accompany them on their travels. When the wanderers strayed too far, the cat would pick them up as she would her own kittens and return them to the nest box. This propensity to explore at last brought an end to our happy relationship. They had grown almost too large for Gloria to feed and were becoming a very real burden, when fate stepped in. One morning the garage men came to work to find Gloria all alone. An examination of the nest box showed that there were no 'coons in evidence. A patient search by the garage personnel failed to reveal the slightest trace of the missing youngsters. Gloria was very restless. By mid-morning she was observed sitting in a certain spot beside a little ramp connecting two parts of the garage on different levels.

Beneath the ramp was a large, uncovered hole which everyone had forgotten. The opening led to a culvert that served the purpose of leading a brook under the building and down into the near-by Hudson River. Planks were ripped up but no trace of the 'coons was ever found. Gloria approached the edge of the hole and peered into the rushing water beneath. She returned to the spot several times during the afternoon and evening and the next day as well. We might add in passing, that Gloria has raised numerous progeny of her own since then, with complete success.

We have had far better fortune raising our own raccoons than did the garage cat. There was Herman, for example. Herman and two of his brothers were picked up one night while strolling through the dining hall of a large children's camp in the interior of the Park. By coincidence, a very young skunk was also collected on the same night in the same camp. The director of a near-by nature museum, on being presented with the pair, decided to raise them together. Accordingly, he placed the two in a cage and started them off on a milk

▲ 'COON AND SKUNK, on another occasion, became great pals, and the skunk remained a perfect gentleman through many scuffles with its stronger companion

▼ IN THE WILD, most animals do not get as close as this to a skunk, but these two missed each other when separated

formula with the aid of the inevitable nursing bottle.

From the very first, the two became excellent companions. They ate, slept, and played together hour after hour, dashing about the cage in pursuit of each other and staging mock battles during which the 'coon would hide behind the little log in the cage and the skunk would wait expectantly for the charge that followed. The 'coon would rush forward and simply bowl the skunk over by sheer weight and power. The black and white one would squeak in protest and bite wherever his teeth could find a biting surface. Then the 'coon would retreat to a corner and literally hide his head as the skunk nipped him here and there. As soon as this procedure ceased, the 'coon would start the play all over again.

No matter how rough the action became the little skunk was always the perfect gentleman. At times he would stamp his feet as loudly and as furiously as he could and raise his chrysanthemum-like tail on high, but when his play-fellow approached, he would dive beneath the 'coon's onrushing body and do his best to bite where the biting would do the most good.

As time went on, the 'coon outgrew the skunk in size, and we became alarmed for fear the smaller animal would become injured during one of the spirited contests. In fact, the 'coon developed the unfortunate habit of grasping the skunk by the tail and pulling it about. We noticed, one day, that the skunk was beginning to lose some hairs from his tail and, at this juncture, we determined to call a halt. Fun was fun and the skunk still appeared to enjoy the engagements, but we decided to separate the two. This occurred some nine months after the pair had originally been brought together.

From the beginning, the little skunk had determined the final outcome of each "battle." In his own good time he would invariably back Herman into a recess and cause the chastened 'coon to "cover up" with forepaws over his face in ludicrous fashion, like a small boy told to stand in the corner until directed to join the social world once again.

Herman was very unhappy after the removal of his companion. He would pace the cage and was not at all friendly toward those who cared for him. The skunk, when released upon the floor of the animal building for a daily promenade, would wander over to a spot directly beneath the 'coon's cage and endeavor to reach it. We could not resist the temptation to place the two together once more. Our good intentions were ill fated, however, for we found it necessary to separate them about a week later. The 'coon had really become too rough, and the skunk now showed definite signs of being prepared to use sterner and far more formidable measures whenever Herman stepped beyond the bounds of gentle play.

Both of the animals are still with us but they now occupy quarters far apart. Herman soon became angry with the person who looked after his wants and sank his long teeth into the man's forearm. Raccoons really know how to bite and are thoroughly capable of demonstrating this fact. Gone were the days when the once friendly animal would perch upon our shoulders and, with his clever forepaws, investigate our hair and our ears while his soft quavering voice kept up a continuous "conversation." His disposition had suddenly changed, and he was no longer to be trifled with.

▼ **Trailside Museum** visitors regard 'coons as individuals, not as co-partners in the manufacture of a raccoon coat! This pair enjoy water trickling from a bubble fountain cut in rock

We have had more than one evidence that raccoons will accept strange bed-fellows. Herman and the skunk were not our only example. Our 'coon cage is really a very elaborate affair with a large sun area and a covered portion, beneath which an artificial brook flows constantly. Next door is a similar compartment dedicated to the comforts of a very beautiful, semi-tame red fox. On several occasions, the fox has contrived to raise the sliding door that divides the cages. We have discovered him in the morning in the same nest box with our three 'coons, his bright red head contrasting strangely with the grayish yellow fur of the uncomplaining 'coons. There was every sign that the 'coons accepted his presence without any strenuous objections.

When we entered the cage, the 'coons would leave him. They would come over to us to see what was going on and, on being satisfied that there was no food in sight, would reenter the little house and join the fox once more. Whether the lone fox was prompted to seek companionship or whether he simply escaped from his cage for the sake of escaping, we do not know. There were a number of other nest boxes in the enclosure, but the red fox invariably chose the one that contained the 'coons. And in order to return the fox to his rightful enclosure, we found it necessary to drive him from the nest box.

Of the several score of raccoons that have come and gone in our Trailside Museum cages, very few have been vicious either toward us or toward other animals with which they came in contact. Nevertheless, we did have one once that would actually pursue any of us and do his level best to tear us to bits. The majority, however, permit one to take certain liberties with them, despite some years of captivity. We have succeeded in taming 'coons that were caught when thoroughly adult, to the extent that they would reach in our pockets for peanuts and would not resent it when we scratched their ears while they were engaged in seeking food elsewhere upon our persons.

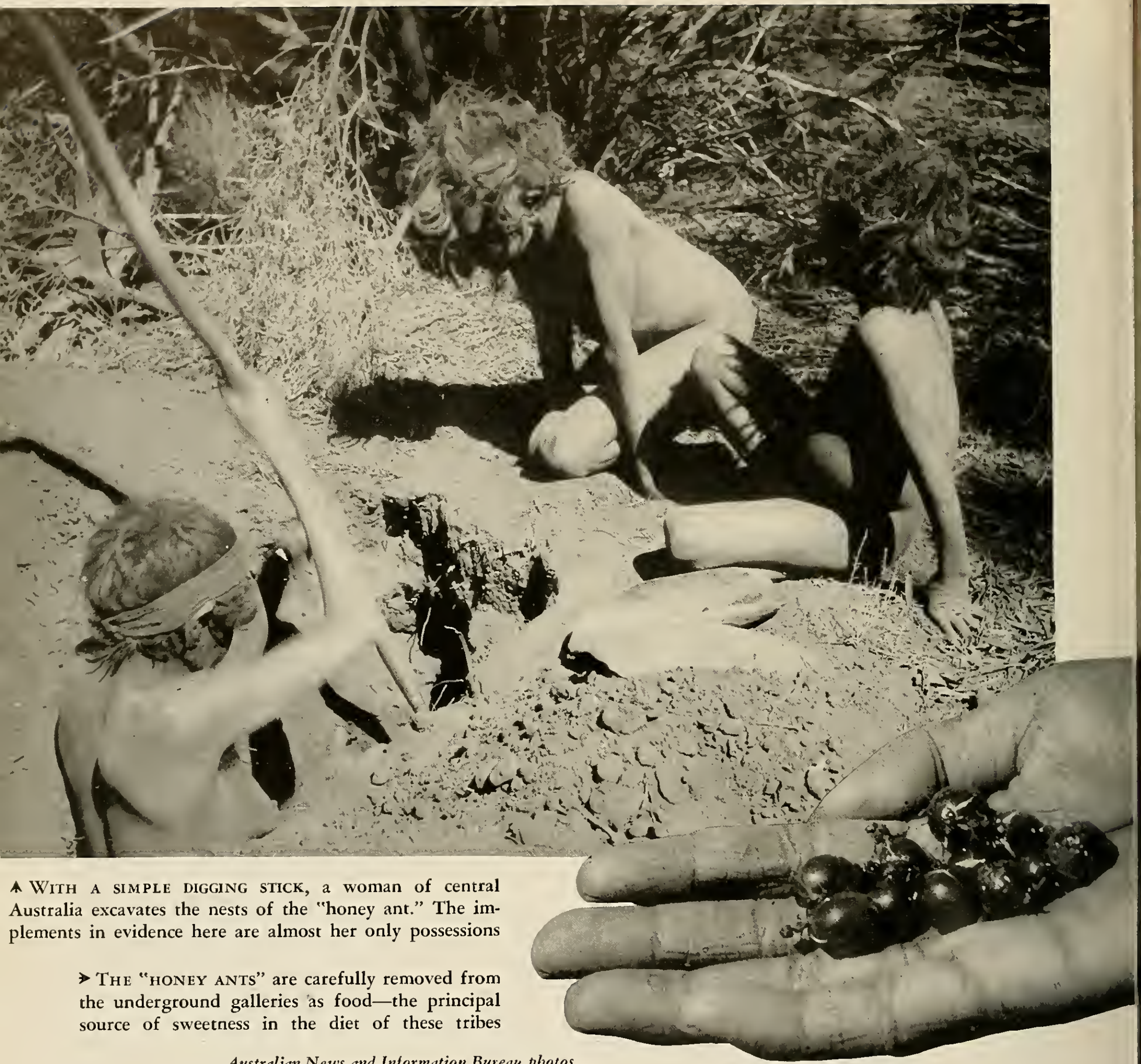
Raccoon young are not at all difficult to raise, provided one has the requisite time. They accept milk eagerly, almost from the very first, and do not object to cod-liver oil, lactose, or other necessary dietary novelties which we introduce for their welfare. The vocal accomplishments of 'coons, especially during the early stages of their growth and when food is in the offing, are amazingly varied. 'Coons succeed to a remarkable degree in informing their human nurses as to their wants and especially their dislikes.

We once made sound recordings of young 'coons as they cried lustily for their bottles and then we added the contented sounds that came when the nipples were firmly in place and warm milk flowed freely. We played the records for a number of naturalist friends and were surprised to observe that only one man could identify the sounds. The answer was that he had brought up a family of 'coons himself and, to him, the sounds were unforgettable. The anticipatory sounds were high pitched, muffled shrieks, and the "contented hour" was signalized by soft purring-like noises which certainly bespoke happiness or, at least to human ears, indicated pleasure resulting from the fulfillment of a desire. Anger is expressed by growls, rasping barks, and "coughs."

The small masked fellows are appealing pets and, like many young animals, show their dependency upon their owners in numerous ways. When old enough, they will follow human companions about and climb upon available clothing. They seem to enjoy riding about in one's arms and will go to sleep with perfect confidence in a convenient lap whenever the occasion and the desire coincide. When weaned, they will accept about the same food as a dog, including meat, fish, bread, apples, melons, bananas, oranges, and peanuts. Incidentally, it is by no means true that raccoons always wash their food before eating. One who contemplates keeping a 'coon as a pet would do well to check with his State Conservation Department, for many of our states have restrictions and require special licenses.

We have released more raccoons than we have kept, for we do not believe in the wholesale collection of animals that belong in the woods and not in cages. Furthermore, the ones we have maintained in captivity have mainly been brought to us as helpless young, as injured adults, or as pets whose owners had become tired of them. Anyone who raises an animal from infancy to adulthood, assumes a definite responsibility, and it is well to remember this when one adopts a young 'coon which will one day pass beyond infancy.

▾ A YOUNG 'COON that has learned to trust human companions will curl up without fear at one's feet or in the lap. But their reactions are not always predictable, and they know how to bite



▲ **With a simple digging stick,** a woman of central Australia excavates the nests of the "honey ant." The implements in evidence here are almost her only possessions

➤ **The "honey ants"** are carefully removed from the underground galleries as food—the principal source of sweetness in the diet of these tribes

Australian News and Information Bureau photos

Australian Natives eat "LIVE" SUGAR

By Charles P. Mountford

Ants that conceal a quantity of sugar in their abdomens are a vital part of the diet of aborigines living in sweet-starved Central Australia. Despite the ants, however, the average hinterland native is able to get in one year only about as much sugar as is contained in a small piece of candy. Sugar to these primitive people is as precious as salt to the Bedouin.

The honey ant, for which aboriginal women dig through many feet of hard-baked earth with primitive digging-sticks, looks like a tiny amber-colored cherry that has grown a tiny head and struggling legs. But it starts life looking very much like other ants. Science knows very little about these insects, and the natives themselves have taught me more about them than I have learned from books,—which is little enough. *Camponotus inflatus* is the textbook name for the species, and its method of food storage is rather exceptional. The honey ant lives under mulga trees—a variety of acacia restricted to the arid parts of Australia—, and it is from the mulga flower that the ant collects its honey.

Most people are familiar with the bee's method of storing honey in waxen cells against the time when none can be gathered, but honey ants select certain members of their own colonies as repositories. The chosen are fed with what the others collect until their abdomens are inflated to a diameter greater than their original length. They become little golden balls of honey, about the size of peas, on which head and thorax wag helplessly. When they are inflated, the ants are no longer capable of locomotion. In the nest of the honey ant there is a vertical shaft, often six or seven feet deep. At intervals of from nine to twelve inches, this opens out into circular chambers. In these the *jirumba*, as the natives call the ants, are found.

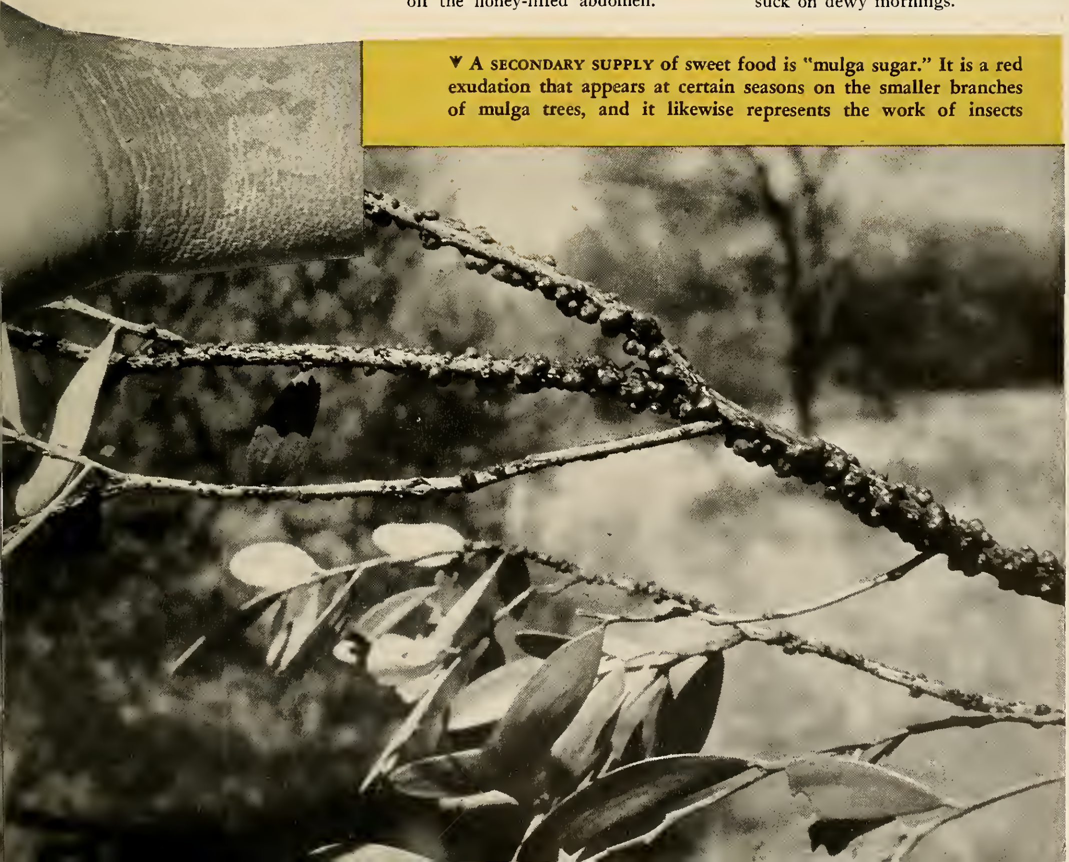
When a native woman detects signs of a honey ant nest, she scrapes the surface of the earth very carefully with the edge of her wooden dish until the loose top sand has been removed and the vertical shaft revealed. Then she uses the dish and a chisel-pointed digging-stick to follow the shaft down. She digs cautiously, because the abdomen of the honey ant is thin, tightly stretched, and easily broken. As she reaches each gallery, the woman carefully removes the ants with her finger and places them in her carrying-dish.

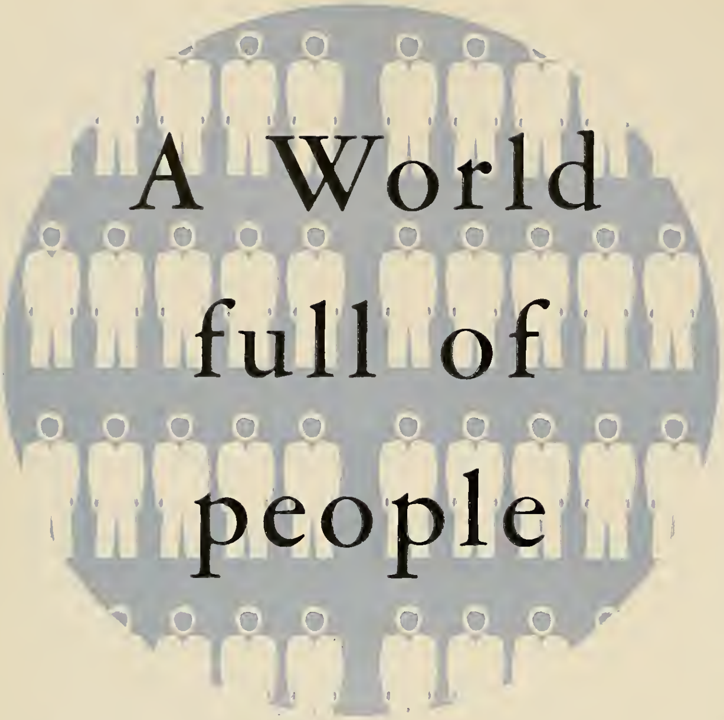
Strict tribal rules of food-distribution forbid the food-gatherer to eat what she collects. All must go to the camp for fair sharing. When the ants arrive at the camp, there will be joy, and the woman digger will be compensated for her hard work by the luscious taste of the ants and the satisfaction of her people. The natives take the tasty morsels by the head and bite off the honey-filled abdomen.

I have taken part in such a feast and have found little difference in taste between the honey of the ant and that of the bee. Sometimes, the natives eat the whole ant. "Makem taste better," they say. Personally I prefer my honey with as little ant as possible.

Another meager supply of sweetness for the aborigines comes from mulga sugar (the aborigines call it *woma*), a red exudation that appears at certain seasons on the smaller branches of mulga trees. This, too, results from the work of an insect, of which little is known, which pierces the mulga bark and buries itself underneath. As far as I know, the aboriginal has no name for this insect. "Bleeding" from the wound and excretions from the insect itself, produce small drops of sweet red gum. The natives pick the branches at the right moment and steep them in water to produce a sweetish liquor, which they drink. Small sugary coverings of certain insects can be found on the leaves of gum trees, but the only other source of sweetness for the natives is desert flowers, which they suck on dewy mornings.

▼ **A SECONDARY SUPPLY of sweet food is "mulga sugar." It is a red exudation that appears at certain seasons on the smaller branches of mulga trees, and it likewise represents the work of insects**





A World full of people

By HARRY L. SHAPIRO*

Chairman of the Department of Anthropology,
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The facts of population are vital t
every nation and to the internationa
adjustments of the world. Here th
basic principles and their significanc
are discussed in non-technical languag

For who can count the multitude of men?
They are like grains of sand.
And who can know their diverse nature
and condition,
From the most base to the most exalted?

PEOPLE are the most valuable of natural resources—and the most universal. Perhaps this very ubiquity, together with mankind's propensity to replenish itself with little or no encouragement, accounts for the tendency in many quarters to take population for granted. Indeed, it is probably fair to say that the existence of any problem in this connection would have seemed novel a few centuries ago. If any problem existed then, it was apt to be merely one of stemming the flood of mankind that threatened the available means of subsistence.

We have, however, become aware in recent times that there is more to population than its mere size or its growth, important as these are in a national economy. Population, we now recognize, has a complex structure, with a dynamic balance between the component elements. Alterations in one of these elements, can lead to significant changes in the whole. But more than these quantitative aspects of numbers and rates, population has a qualitative side. Two populations of equal size and of similar age structure may yet be vastly different in biological fitness. This is a phase of population much less known or understood, but obviously one of the utmost importance. To study the behavior of aggregates of people, how they maintain their size, why they increase or decline; to analyze such aggregates into their significant elements and to determine their mutual adjustments; to ascertain if such aggregates are improving or degenerating in quality—these are the aims of the biology of population. It is a subject of the greatest practicality for the welfare of a nation.

A population is the total number of individuals who may be embraced within a given classification. Thus we may speak of a school population, the population of New York City, the male population, or the population of the United States. Statistically considered, these populations may be described by various mathematical devices, and, when chronology or comparison with similar groups is added, we may deduce from such mathematical summations certain trends and tendencies. Because all the units or subdivisions of a nation are influenced far more by each other than any one is by similar units in other nations; because intermixture is more common within national boundaries than across them; because the national destiny combines all the subdivisions into a kind of biological as well as cultural, political or economic entity, we have come to think of the total national population as a biological expression susceptible to scientific study and analysis.

I have frequently speculated a little on the origin and evolution of our

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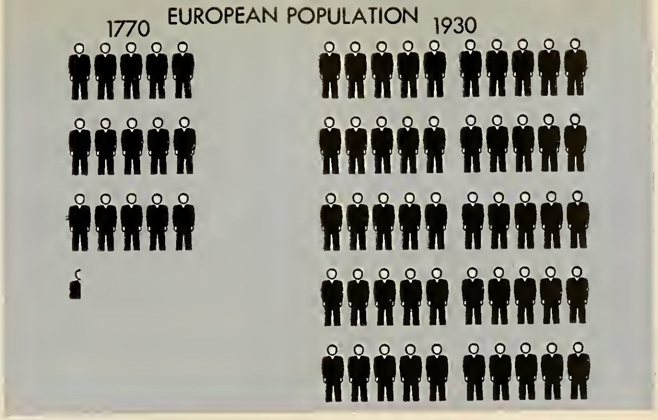
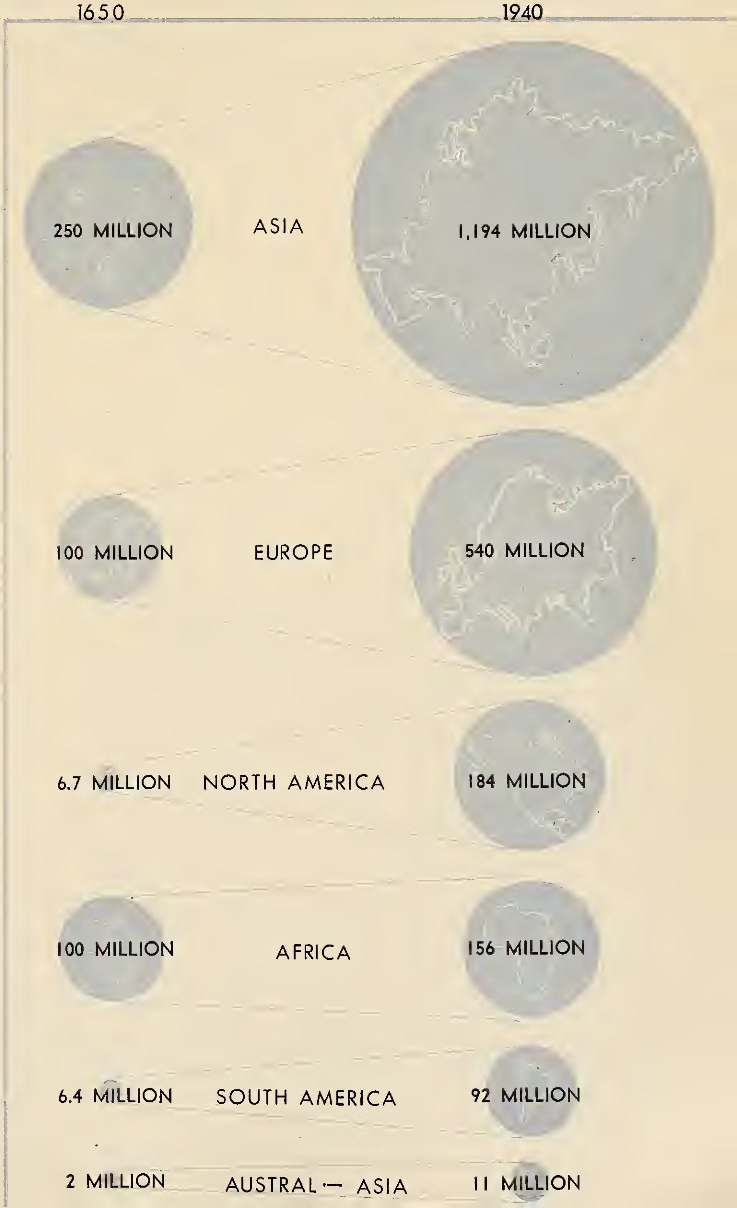


RAPID GROWTH of population due to in- strial development, lowered death rate, and e development of resources in the New orld

interest in the biology of population, and it seems to me that much of it has been stimulated by the accumulation of data provided by the census. Before the notion of census taking became an established function of national governments, little if any attention was directed toward the study of population as population. What enumerations were in existence were outgrowths of other concerns. Tax lists had to be drawn up, or man power resources for military uses had to be mapped. Enumerations of people also had value for the church and were significant for various political and economic purposes. But these counts were never primarily instituted for biological reasons and were rarely employed for such ends. Although they go far back in recorded history, they were with few exceptions, desultory and unsystematic. Not until fairly recent times did the notion become established that periodic and systematic enumerations of the population are valuable and necessary enough to warrant their being a fixed function of the government. The earliest official census, as distinct from estimates, seems to have been initiated in New France in North America and was continued there from 1665 to 1754. The United States was among the first of modern nations to establish, in 1790, a regular census repeated at fixed intervals. Its purpose was primarily political, since it was designed to serve as a basis for representation in Congress. Great Britain began periodic enumerations in 1801; and by the end of the nineteenth century, the economic and political necessity of census taking was recognized in most civilized countries in the world. The necessary organization, however, for an accurate census in a large country still proves a stumbling block for many governments, with the result that even official national censuses vary widely in their reliability from country to country. But whatever the origin of the census



GROWTH OF POPULATION BY CONTINENTS. ote that the increase has been much greater n some continents than in others and that he distribution of population throughout the vorld is quite different than it was a few enturies ago may have been—political, economic or military,—the study of population problems proved to be one of its unforeseen and most valuable by-products.

Since the first censuses provided little more than total counts, the pioneer students were restricted, by the very data available, to the problem of the total growth of national populations. It happened, however, that the trends revealed by these initial enumerations were startling enough to warrant serious thought. As early as 1755 Benjamin Franklin was commenting that the population of the United States was doubling every 25 years, and by the end of the eighteenth century Malthus already had enough available data to be impressed by the dangers of a population growing beyond its means of subsistence. How rapidly various European nations were growing may be seen by comparing Europe's population in 1770 and 1930. In 1770 it was 152,500,000; 160 years later it had increased to about 500,000,000—something like 3 times. This remarkable expansion seems to have begun in Western Europe and to have gradually spread throughout the continent. In America the rate of growth was even more rapid than this, as it also was in the British colonies in New Zealand and Australia.

The phenomenon was so widespread and so decisive that at first expansion was assumed to be the natural condition of all populations, and alarm was frequently expressed for a future in which a world bursting with people would find its means of subsistence inadequate to support them. We now know that this increase was merely one phase of the world's population history and that expansions on this scale had never occurred before. Indeed, a little arithmetic demonstrates how unlikely it is that populations in the past have grown at a rate anywhere near their full reproductive possibilities. If, for example, reproduction were uncontrolled, a woman could give birth to 5 or 6 children betwen her 17th and 27th year. If 4 of the children survived and reproduced in their turn at the same rate, the population would double every 27 years. But this is not the highest rate possible by any means. If a woman survived to her 35th year, she could easily bear 8 or 9 children. With only 6 offspring surviving, the population would triple every 35 years. Thus a single couple reproducing at the first rate would yield in 540 years, 2,097,000 descendants, and at the second 45,956,000. In 1080 years the respective number of descendants from one husband and wife would reach 2199 billion and 1,656,000 billion. Obviously, then, mankind has not been increasing at anywhere near its full potential. And the acceleration in recent centuries cannot have been going on for very long. If we project backward the modern population of Europe, reducing it by the same rate that it has increased over the past 160 years, we would find ourselves in an empty Europe at the beginning of the Christian era.

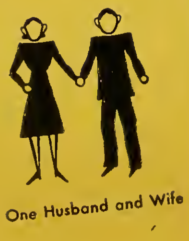
When we recall that man is estimated to have an antiquity of about one million years, it is obvious that he has neither increased steadily nor at his full capacity. Over much of this period the human population must have remained static or even retrogressed. Although statistical evidence of this nature does not exist for mankind's early history, we have some fragmentary evidence to prove that populations are not forever expanding.

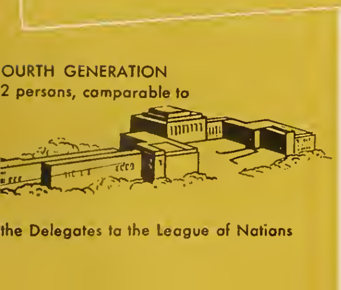
Japan, for instance, had a population of 28.1 millions in 1721, and 135 years later her population was roughly the same (28.9 millions). Spain, in the seventeenth century, had passed beyond one growth phase and was in a state of decline, a circumstance rarely mentioned in connection with her political decline and her colonial policies.

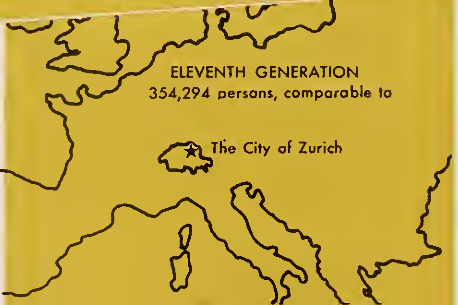
Why is it then that populations increase, decrease, or remain static? There are various reasons given, but let us first examine the direct mechanism by which the process itself is controlled. There are four functions whose mutual adjustments determine the curve of a population. These are birth rate, death rate, immigration, and emigration. By the rates of these and by these alone is the size of a population determined. The differential between birth rate and death rate

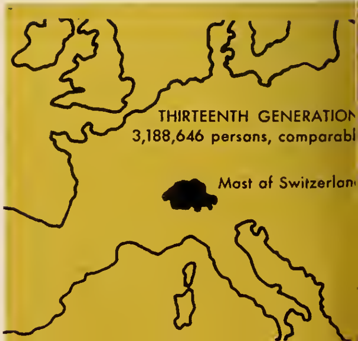
if

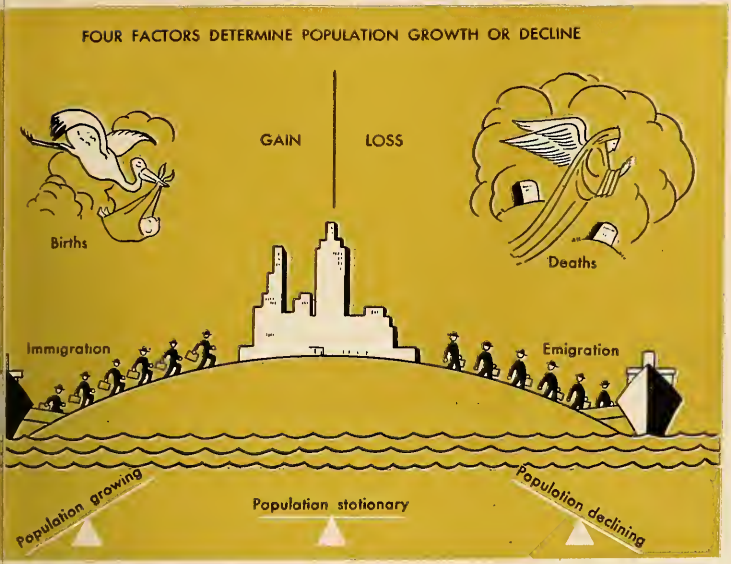
one husband and wife had six children and each pair of children had six children, they could populate the entire world in 19 generations











gives us the natural increase or decrease—the amount by which a population, by the success or failure of its own efforts, is adding to its numbers or losing them. Ordinarily birth rate and death rate alone are the decisive factors, but under certain circumstances the displacement of population from one country to another may strengthen the national trend of a population or counteract it. Immigration to the United States during most of its history was a significantly positive contribution to its remarkable growth. Ireland during the famine years was unable to replace by its own natural increase the losses suffered by emigration. France in recent years has sought to redress her unfavorable balance betwen births and deaths by permitting the immigration of Italians and Poles. But in most countries, and during most of the time, the balance of births and deaths determines the issue.

Natural increase is achieved when the birth rate surpasses the death rate, and the greater the difference the larger the increase. But birth rate need not be increased to attain this favorable balance, it may be accomplished by a decline in the death rate. Where both rates are changing the natural increase will be proportional to the relationship between them. During the past century the birth rate of western Europe was dropping steadily, but the natural increase was maintained because the death rate was also dropping and in some cases more rapidly than the birth rate. Since the drop in death rate has slowed down and the drop in the birth rate threatens to approach it, the natural increase is shrinking away. It is apparent, therefore, that an explanation of why populations increase or decrease must be based on the factors that govern not only the birth rate but also the death rate and the balance between the two.

Among the variables that one might expect to be most effective in determining differences in birth rate is innate fertility. We are so accustomed to having the high birth rates of the Japanese or the Russians or the Southeast Europeans contrasted with the dwindling families of the French, English, and Americans that almost insensibly we come to assume a difference in fertility. Similarly we are apt to attribute a greater power of reproduction to primitive people than to the highly civilized. Some authorities, however, deny that any real distinctions can be drawn between the various races or peoples of the earth in this respect. They maintain that unhampered reproductive rates are approximately the same for all mankind, somewhere between 40 and 50 per thousand, and that whatever deviations occur are attributable to inhibiting factors. For all practical purposes, according to this view, we may neglect any possible variation in innate fertility and speak only of limiting circumstances. The following chart, based on figures published by Raymond Pearl, supports this contention, but it should be stressed that the available data are by no means adequate for a universal generalization. Sterility, however, in so far as it lowers the average fertility of a population does seem to occur more frequently in highly civilized societies than in primitive ones.

Leaving aside therefore the question of any inherent differences in reproductive powers, there are two principal sets of limiting influences on birth rates. One is social and long term, the other is catastrophic and short-lived. A study of primitive as well as civilized sex customs reveals a diversified series of habits and rites that limit in varying degree the natural fertility. Sexual taboos of diverse descriptions, for example, are commonly practiced among primitive people. Sexual intercourse may be forbidden before ceremonial occasions, before battle, for ritual reasons, and for varying periods in connection with menstruation. In extreme forms, a woman may actually be excluded from the possibility of reproduction during half her child-bearing period. The custom among certain primitive

IFTEENTH GENERATION
697,814 persons, comparable to
zeable section

SEVENTEENTH GENERATION
258,280,326 persons, comparable to
From the Channel

NINETEENTH GENERATION
2,324,522,934 persons, comparable to

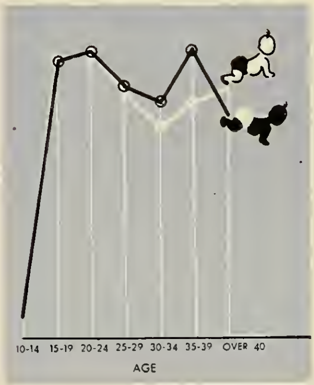
women of nursing children for an extended time tends to reduce the chances of conception, and in fact the practice is deliberate with many of them who desire to keep their offspring at a minimum. It has been reported that some primitive groups who cultivate this device keep their children down to 4 or 5 per woman.

Abortion is by no means universally accepted, of course, as a method of birth control; nevertheless it is commonly practiced in many societies, our own not excepted. How effective or how extensive a method it is we do not know, since accurate information is lacking. Certainly in most primitive societies knowledge of it is widely disseminated, and inquiry readily elicits specific details of procedure as though recourse to it were frequent enough. Estimates for a city such as New York run into colossal figures. One estimate suggests that as many conceptions terminate in abortions as in live births. There can be little doubt that this method of limiting births is one of the most significant in human history.

Another method of reducing the population if not the actual birth rate is by infanticide. This resource is to our minds a revolting practice, yet in certain countries it has been adopted and has received social approval or at least tacit tolerance. It is apt to occur where the pressure of population has become a serious problem. In Tahiti, for example, Captain Cook found the natives openly abandoning female children to exposure and death. The teeming population confined within its narrow island presumably could not expand further and the excess had to perish. Those who doubt Malthus have here an object lesson on the reality of population pressure. China, too, has countenanced female infanticide, and in times of stress its practice increases. So common a thing is it in China that its profound results may be read in the marked excess of males over females ranging from 10% to 50%.

Less direct than these is the effect of various other by-products of social custom. Among them I might mention the increasing age at marriage which, at least until very recently, was evident in highly civilized societies. Economic causes are generally assigned to the tendency to delay marriage among us, but in at least one primitive group with which I am familiar this delay arises from a gerontocracy where the old men are dominant and pre-empt most of the young maidens for themselves, leaving the young men to make the best they can of the old ones or wait for their turn with advancing years. The tendency to delay marriage, other things being equal, results in smaller families.

Concubinage, which one might expect to enhance the birth rate, is said on the contrary, to depress it, since a large number of women are removed from the full exercise of their reproductive possibilities. Women under this system are individually unlikely to have as many children as they would if married to one man, in spite of the impressive totals of offspring that a sole male under such a system may pile up. Similarly large scale prostitution has the same consequences but for a different reason or reasons, one of which is the prevalence of social diseases among the practitioners of this profession. But social disease apart from its existence among prostitutes is also a very significant factor in reducing the birth rate in the general population. This alone was responsible in large measure for the rapid depopulation suffered by Polynesia in the nineteenth century. Let me cite a single instance. The Marquesans at the time of Cook's visit toward the end of the eighteenth century, possessed a population estimated at around 100,000. In 1920 there were about 1600 natives left—less than 1/50th. A survey I made there ten years ago, disclosed a large number of sterile marriages and a high prevalence of miscarriages. Gonorrhea and syphilis were rife. The prospects looked very bleak indeed that this handful of once magnificent Polynesians could long survive. About 15 years ago, however, one of the government physicians began to combat social diseases in a few localities, and in a relatively short time the birth records began to show a remarkable increase. For the first time in over a century a favorable balance was established precisely in the localities where modern medical treatment had been administered.



After Raymond Pearl

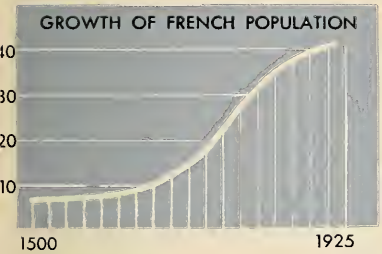
▲ THE FERTILITY OF NEGRO AND WHITE WOMEN appears to be similar. The chart shows mean pregnancy per 100 ovulations in women who married only once, had no gynecological disease, and did not use contraceptives

It has frequently been suggested that urbanization, with its attendant nervous tensions, may be one of the causes of sterility and reduced reproductive capacity. If it is, we cannot assess its role in the complex of factors which are operating toward this result. One of New York's most distinguished gynecologists once told me that he was able in a fair proportion of sterility cases to achieve cures by prescribing rest and travel.

Perhaps the most effective curb on the birth rate is the various techniques of contraception. The idea of contraception is a very old one. It was known in antiquity. But only in recent times has its practice become almost universal in some countries and in certain classes in most civilized societies. Probably no other single factor has been so effective in cutting down the birth rate. Certainly the present drop in birth rate coincides with the adoption of contraception, and this rate is lowest where contraception is most widely used and highest where it is unknown.

In the long run, the catastrophic checks on birth rate are less potent than those already mentioned. Their immediate influence may be more drastic, but, unless a population is already in decay or sharply reduced in number, recovery from them is fairly rapid. Thus famine, which has swept over China and India repeatedly, carrying off millions to death and cutting back sharply the birth rate, seems to have affected but little the general reproductive rate. It has been calculated that between 108 B.C. and 1911 A.D. China was subjected to 1828 famines, or almost one a year. Britain between 10 A.D. and 1846 suffered 201 famines, or 1 every 9 years. India endured 34 between 1769 and 1878, or 1 every 3 years. While these disasters may temporarily reduce the birth rate, they seem to have no permanent or long enduring consequences on reproductive tendencies. In other words the recuperative ability of a population soon makes up losses suffered from such causes when the short-lived cause itself is removed. Long continued war may also exercise a depressing effect on the birth rate. There has frequently been observed a sharp but temporary rise in birth rate at the initial stages of warfare, but this spurt declines into a lag as war continues, and its consequences extend into the post-war period. In the present conflict, the magnitude of the dislocations are beyond our experience, and it would be hazardous to base predictions on the past. After the last war, however, birth rates adjusted themselves fairly rapidly to the pre-war positions and continued their evolution from that point.

The other component in the equation of natural increase is the death rate. In pre-industrial societies and among most primitive groups, this perhaps more than the birth rate is responsible for the dynamic status of a population. There are exceptions, to be sure, but in general a population not appreciably affected by artificial checks on the birth rate will increase as its death rate drops, and will become static when the death rate approaches the birth rate. In the past, the rise of the death rate through epidemics, famines, war, or disease has been more effective in reducing the rise of a population than fluctuations in the birth rate. Conversely, the amelioration of living conditions, improvement in public health, and advances in medical care permit a rapid increase in population by reducing the death rates. The phenomenal expansion of the population of Europe and, indeed, of the world during the nineteenth century may in large part be attributed to these factors. Only as the birth rate begins to follow suit and to overtake the decline in death rate is a static or declining population once more established. This has already happened in France. It seems about to happen in England and the United States.



▼ THE TYPICAL S-SHAPED CURVE of population growth, here represented by France, shows a slow beginning followed by a rapid rise and finally a gradual leveling off. The curve for the United States, rising from just under four million in 1790 to 132 million in 1940, would show a rising slope that has scarcely begun to flatten out

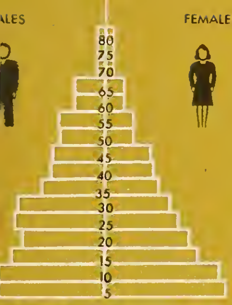
The extraordinary growth which the populations of the world have undergone in the past century or more has stimulated a good deal of speculation on the nature of the phenomenon. Raymond Pearl has reduced it to an equation and has generalized it to the form of a sigmoid or S-shaped curve. Such curves begin by rising slowly, reach their steepest slope at the middle of their spans and then decelerate gradually. Their application to populations is based on the thesis that a population becomes static when it has reached the limit of the current means of subsistence. When these sources of subsistence are increased, growth takes place. But the new spurt is proportional to (a) the absolute amount of growth already achieved and (b) the amount of unutilized or unexhausted means of subsistence. Such curves fit quite well the history of modern populations and have served many students in their predictions on the future size of existing aggregates.

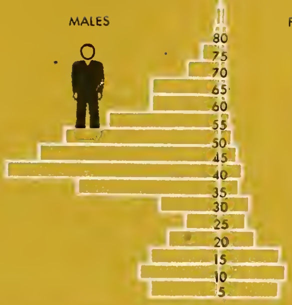
But to describe the phenomenon does not explain it. Corrado Gini has a somewhat anthropomorphic explanation. He considers a population to be something like an organism—that it has a youth, a middle, and an old age. During its vigorous youth it grows rapidly. Then as increasing age makes itself felt, it begins to lose its reproductive force and becomes static or even declines. It would be difficult on this basis to explain the vigor in the ancient loins of China and Italy.

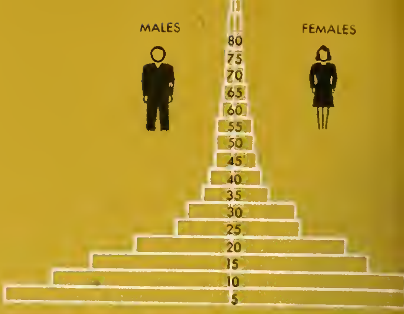
Warren S. Thompson, on the other hand, stresses the importance of environment, by which, I take it, he means agricultural and technological improvements. Looking at the full sweep of man's history, we do see definite increases in the density of population when new procedures or inventions permit the support of larger numbers. Hunting or food-gathering societies are not usually able to maintain a population as large as an agricultural community in the same area. In aboriginal America, the largest concentrations existed precisely where settled agriculture was well organized. Cities and large populations in the Old World first appeared in the rich valleys of the Nile, the Tigris, the Euphrates, and the Indus, where agriculture received its initial development. The remarkable expansion of population that is so striking in recent centuries coincides with the advent of industrialism, the expansion of trade, and the exploitation of the New World. These events have enriched the sources of subsistence and permitted a new growth of population.

To list the total number in a population or even to define its rate of growth does not tell the whole story. A population not only has size; it also has structure. By this I mean that populations are composed of different kinds and categories of people, the numbers and relationships of which vary from time to time and from place to place. If we classify a given population according to sex and age, we can plot the percentage of the population in every category. Normally, the result is a pyramid with the most numerous class where one naturally expects it, in the youngest age at the bottom, and the least numerous among the most aged at the top. Such a pyramid tells us much about the past, present, and future of the population it represents. If the pyramid has a relatively broad base, we may anticipate, other things being equal, a rapidly growing population, since the future reproducers of the populations are to be found in the youngest generations. On the contrary a population barely replacing itself will have a relatively narrow base.

The profiles of the populations of the United States and various western European countries reveal a striking change during the past century. As the death rate has declined, the number in the older age classes has increased. At the same time the base has contracted due to the reduction in birth rate. We see, therefore, a change in the age structure of these populations that has had a profound significance not only on the growth







After Andrew W. Lind

▲ Under normal circumstances there are more young people than old ones in a given population, and the age groups between show a fairly regular decrease in numbers. Note also that the number of males (*left of mid-line*) is approximately equal to the number of females (*right of mid-line*). This diagram shows the total population of the Hawaiian Islands in 1930

▲ But when young and middle aged men without wives or families move into a region, a bulge appears on the male side of the population pyramid. The diagram above shows this in the Chinese population in Hawaii in 1910

▲ When young people predominate in a population, the pyramid has a wide base and thin top, as in the case of the Asiatic-Hawaiian population in 1930. This diagram shows that mixed marriages have been fairly recent and productive, and the children have not had time to grow up

of the population but also on its biological and sociological characteristics. As the senile and old increase, the rest of the population have to shoulder a greater burden, made up of those who not only are non-productive but are also in need of care. The social agencies to tend the chronically ill and the incurable, and the financial obligations to support the superannuated increase at an alarming rate. The number of productive workers to discharge these growing social responsibilities becomes relatively fewer. This in itself might have a ramified series of reactions on the social organization, but how far their effects may be modified by technological advances that make up for the relative loss of workers cannot be easily estimated.

An aging population, or to be more exact a population with an increasing proportion of middle-aged and senile individuals, may influence the social, political, economic, and intellectual orientation of a nation not only directly through its voice in the government but also indirectly by more subtle means. Even though we may not have at hand objective evidence on this possibility, it is a legitimate field of inquiry. One cannot help but wonder whether a young Elizabethan England would have approved of the cautious, elderly appeasers of Chamberlain's England. I do not, of course, wish to imply that the difference between these two eras was simply a matter of the age of their respective leaders. I am aware, moreover, of the complicated background of the pre-war situation. And I know that Mr. Churchill celebrated his 70th birthday just the other day. But is it altogether unreasonable to expect the policies of nations to reflect the age of the policy makers and of the electorate?

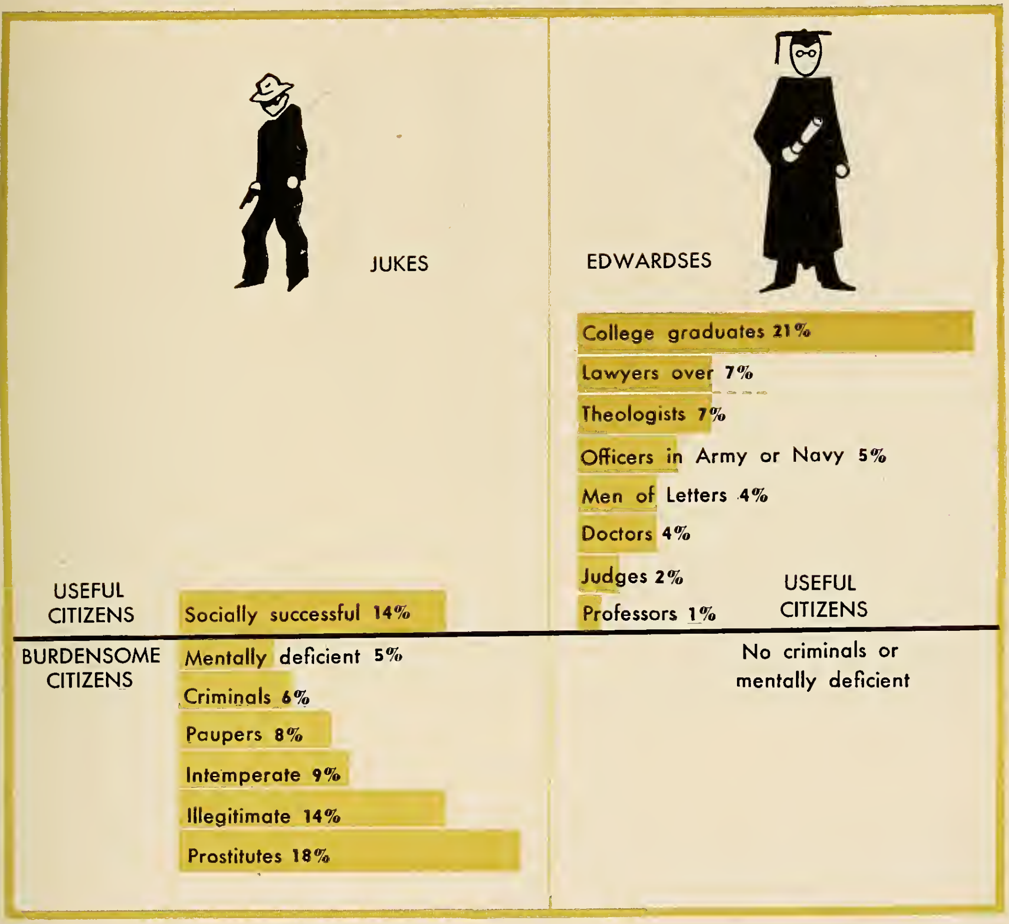
Age and sex, however, are not the only components of population. Indeed, the only limit to the breakdowns and the classifications to which a national aggregate may be subjected lies in the records available. Most of them, however, are temporary and ephemeral characteristics of little or no biological importance. Even much of the census information serves no biological ends. It may be valuable, for example, to know the extent of illiteracy by states and other things about the educational status of the populace. Economists may find statistics on home ownership extremely useful. But these data have no bearing on biological structure. Even the age and sex classifications fail to tell us much of the biological quality of the people. Yet it is of paramount interest to know what hereditary differences in quality exist and whether the superior or inferior individuals are increasing more rapidly.

For example, the composition of a population divisible into 3 distinct groups, would undergo changes proportional to the rates of growth of each group. The accompanying diagram indicates the magnitude of change in a hypothetical case within the bounds of probability.

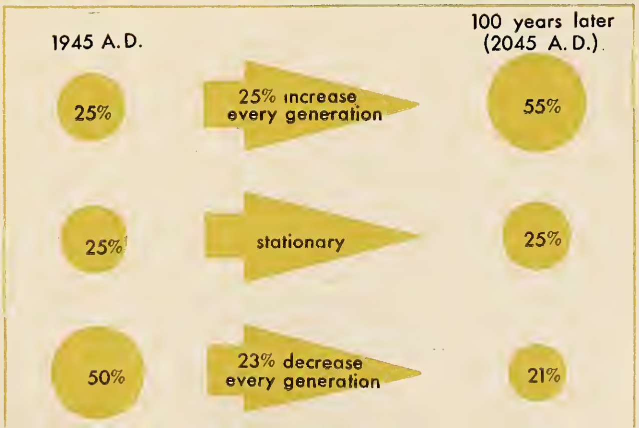
Such changes in the relative strength of diverse components in a population are much more common than we have come to realize, because our data are rarely presented in this form. Yet we may see in the course of the nineteenth century the Scotch drop from 15% to 10% of the combined population of England, Wales, and Scotland. In the United States, immigration and differentials in birth rates changed the population from a predominantly English one to one in which German, Irish, Italian, Polish, and other continental nationalities represent considerable percentages, with a relative if not an absolute loss in the English contingents. It is interesting that this tendency, in force for a century, and one that alarmed certain writers, seems now likely to be reversed to some extent. At present the agricultural south, largely British in origin, is furnishing a disproportionate share of the national increase. The high birth rates of the newer immigrants, formerly viewed with foreboding, have dropped below those of the mountain whites of the South. I cite these figures not because I consider the groups significantly different but to illustrate the possibility of a rapid shift under the influence of persistent trends.

If therefore, a total population may radically change its group composition, is it not possible that its biological quality may also undergo alterations? If the Kallikaks and the Jukes, overburdened with degeneracy, outbreed the Edwardses, may not the qualitative character of the total population suffer? To deny the possibility would be purblind, to affirm the reality would require, however, more knowledge than we possess. Our measures of quality, however, are still so nebulous and are complicated by so many non-biological factors that I hesitate to accept any conclusions drawn from such inadequate yardsticks.

It is true that the poor are breeding more rapidly than the rich, that the rural sections are supplying the populations for our cities, that the agricultural south is increasing at a higher rate than the agricultural north, that Catholics have larger families than Protestants and Jews. But such differentials can only alter the biological character of a population if they are correlated with inherited, qualitative distinctions. Such correlations based on reliable evidence are lacking. The only trustworthy associations seem to run in family lines and not by groups. This is perhaps the key, as it is in so many group statistical studies. We must consider the individual and not his group.



▲ WHEN EXTREME examples are analyzed, it is clear that families differ widely in their contribution to society. The "Jukes" family, embracing 2,094 descendants, have cost the State over $2,000,000. The Edwards family, of whom 1,394 descendants have been traced, have given the nation an impressive number of intellectual leaders. The relative importance of heredity and environment is not evaluated in this analysis


1945 A.D.
100 years later (2045 A.D.)
25%
25% increase every generation
55%
25%
stationary
25%
50%
23% decrease every generation
21%

➤ A POPULATION can change its composition profoundly in a few generations if the various components increase at different rates

Photo by Josef Muench

By RUFUS MATHER BAGG

Geologist Emeritus, Lawrence College, Appleton, Wisconsin

AMONG the various types of vacation lands, none may seem less attractive than the hot, dry desert or treeless plain. For ages, such arid regions have been shunned by man, crossed only with difficulty, and avoided for habitation. They symbolize suffering and have cost thousands of human lives.

Yet the American public has come more and more to look upon deserts as "playgrounds"—places for recreation, relaxation, and the pursuit of outdoor hobbies. What is the peculiar fascination of these once forbidding areas and what has made it possible for man to enjoy himself in them?

Today the luxurious Furnace Creek Inn in Death Valley looks out upon a scene that is fascinating in its utter desolation—a region haunted by the ghosts of pioneers who strove and perished without reaching their goal beyond.

The history of the struggle of both Indian and white man to conquer or even cross this most paradoxical valley would fill a book, and its story has never been fully told.

Long before white men hurried westward to California in the gold rush of 1849, some two hundred Indians are said to have lived in this scorching alkali basin, and they must have watched some of the passing trains of immigrants with ox teams and mules whose members were dying of thirst. The old Indians knew where to find the trickling springs, learned to migrate from place to place along the base of the Panamint and Funeral Ranges, and follow the lines of ripening vegetation. Grass seeds, piñon nuts, cacti lobes, and the huge chuckawalla lizards, one of which the writer saw about a foot in length, formed part of their diet.

In September, 1849, a wagon train left Salt Lake City under the guidance of Jefferson Hunt of the Mormons and tried to go through Death Valley. The story of the tragedy has been told by a survivor, Louis Manly. All sorts of troubles arose. Attempts to make a short cut entailed a long delay that gave rise to anger and sickness. When the wagons were stopped by a narrow gorge, the feeling ran so high that the men fought and neither side would give up until they sawed one wagon in two. Then they split into two groups, with the majority joining Hunt, who later reached San Bernardino but not till after a long, hard struggle.

The other men with Manly went headlong on. Further difficulties caused this group to split three ways. From then on, suffering and tragedy

◀ SUN AND WIND are forever at play among the dunes of Death Valley. Endless patterns are woven and then erased

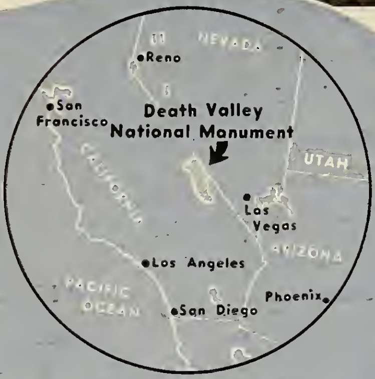
Long of interest only to prospectors and pioneer caravans, the hottest, driest and most tormenting depression in the surface of our land now invites the vacationist with recreation and an amazing array of educational attractions

Photo by Josef Muench

▲ FROM DANTE'S VIEW, 6000 feet above the floor of Death Valley, a scene of utter desolation greets the visitor. The salt deposits far below look like foaming breakers on the shores of an ocean. The farthest mountains in the background are 150 miles away as the crow flies. The highest and lowest points in the United States can be seen to the westward from this spot on clear days

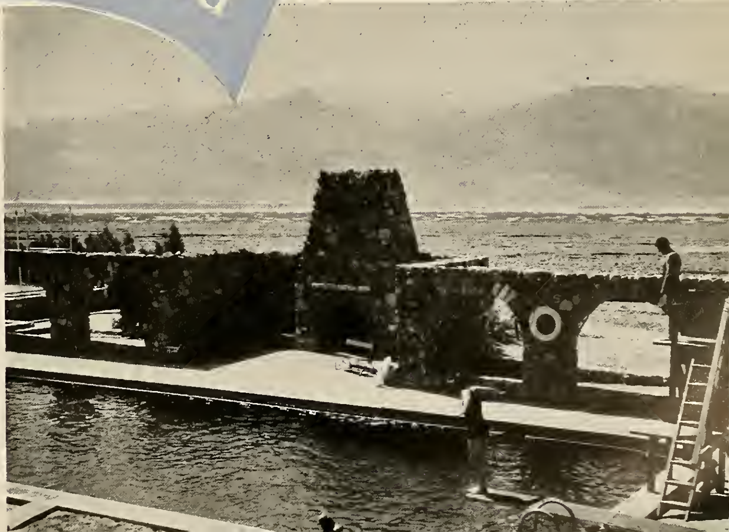
DEATH VALLEY

Desert Wonderland



▼ A LIFE PRESERVER might seem out of place in a region where many have died for lack of water, but not at the attractive swimming pool at Furnace Creek Inn, where one can have a refreshing dip after a hike among the dunes

By Burton Holmes, from Ewing Galloway



stalked the unfortunate travelers. It fell upon the shoulders of Louis Manly, the most hardy, vigorous, and resourceful of the party, to keep the various scattered parties going and, by eventually going ahead and bringing back supplies, to save the survivors of this unfortunate expedition. One group struggled for five days to reach the opposite side of

Photo by Josef Muench

▲ **Spectacular Titus Canyon** wanders through several ghost towns and then lets the traveler out through this gateway onto the floor of Death Valley

▼ **Precautions** are necessary on the scorching roads in Death Valley. Without adequate water and a dependable motor, danger threatens the traveler even today. Approximately 3000 square miles are included within Death Valley National Monument

By de Cou, from Ewing Galloway

WARNING
DO NOT
ATTEMPT
THIS ROUTE
WITHOUT
AMPLE SUPPLIES
OF
WATER
GAS - OIL
GET INFORMATION
WHERE SUPPLIES
MAY BE OBTAINED
AUTO CLUB OF SO CAL.

Death Valley, and the route beyond was by no means easy, because there they found, not the rich California they had hoped for, but the barren desolation of another narrow salt-encrusted depression surrounded by towering ranges. Louis Manly eventually reached settlements beyond, and help was sent.

A new era for Death Valley was ushered in by this tragic series of events, because a piece of glittering rock had been picked up near the scene of so much hardship. It was widely told that a gunsmith, to whom the rock had been taken for use as the sight of a gun, had declared that the ore was solidly veined with silver. Here began a search that lasted for years. Jacob Breyfoggel, a Nevada blacksmith, prospected in Death Valley and brought back pieces of gold veins but could not relocate his find. No traces of it have yet been found, and many other stories of rich prospects have circulated freely. Prospecting continues down to the present day.

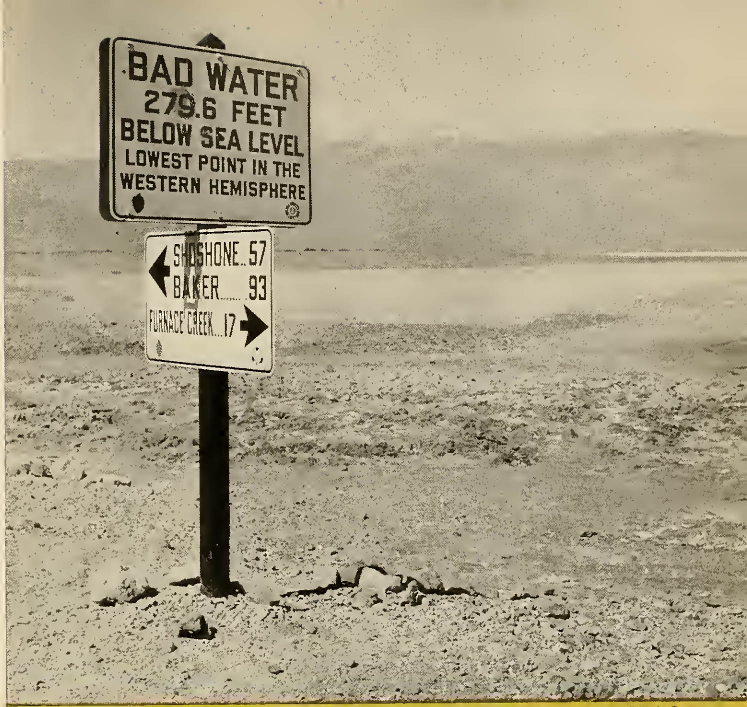
Death Valley is the hottest and deepest valley in the United States. Folded downward between gigantic mountain ranges flanking it both on the east and west, its bottom at Bad Water lies 279.6 feet below sea level. This narrow elongated trough was once an inland sea whose evaporating water deposited the thick beds of various salts, especially *true* salt, borax, and heavy spar, called barite. All of these have been commercially developed but generally on not so large a scale as in the Mohave Desert to the south. As the salt crystallizes and rises in irregular masses above the thick bottom layers, it presents a weird appearance, as one of the accompanying illustrations shows.

What are the attractions of so arid a region as Death Valley? For one thing, it offers some of the most spectacular scenery in the United States. What strike the geologist and scientific tourist are the varicolored rock formations, their fantastic shapes, the rich lake deposits of curious minerals, and the borax beds crystallized in such complex forms.

Approaching Death Valley from the east across the Amargosa Desert Valley, one rides over forbidding jagged mountains and gets his first glimpse at the panoramic gap called Dante's view. It is indeed like a picture of Hades. As far as the eye can reach toward the north lies a shimmering white salt bed. Snowcapped ranges tower above, while far below on the eastern side one looks down upon Bad Water, the lowest point of land in the Western Hemisphere. From the crest of the ridge at Dante's View, 6000 feet high in the black mountains of Death Valley, it is possible on clear days to see both Bad Water and snow-capped Mount Whitney, the highest peak in the United States.

Only since the days of modern automobile travel has it been possible to pass over this desert safely in summer. The region has been made a National Monument, and the Rangers, who patrol the roads even in the hot season, told us that each year in normal times upward of three thousand people wandered bravely through Death Valley, whereas in the early '70's hardly anyone could have traveled over this depression and lived to tell the story. With temperatures that reach 134° F., one does not generally linger in the valley in summer. The radiator is apt to boil with slight exertion, and if one does not relieve the pressure in the hot tires, a blowout can cause a most uncomfortable and even dangerous delay. But in the cooler seasons, the modern conveniences of autos, fine roads, hotels, and camp grounds attract more and more visitors to Death Valley as a vacation resort.

One sees here some extremely fantastic rock formations that have resulted from erosion by wind and water. Not far from the Natural Bridge and only a few steps higher

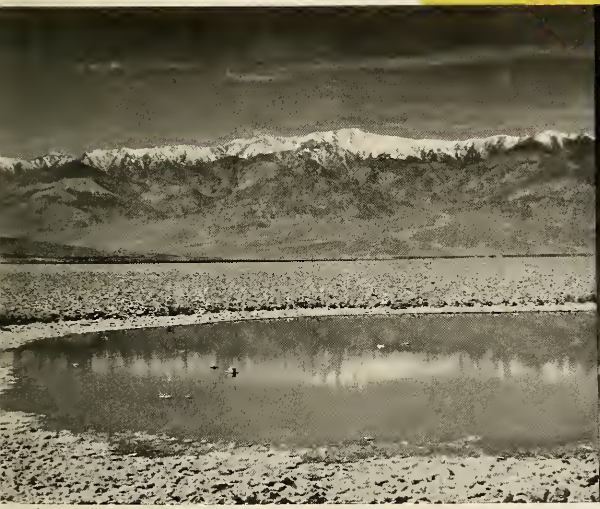


K. Stephen photo, from Black Star

▲ IF YOUR FOOT SINKS into the soggy salt deposits near Bad Water, as is likely, you will be more than 280 feet below sea level

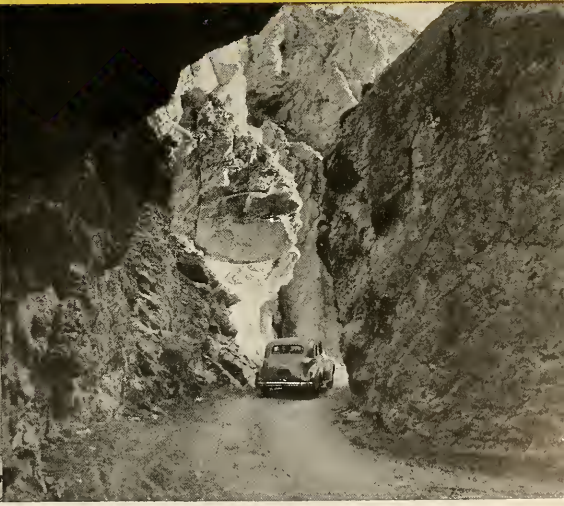
▼ BAD WATER. The pool that lies farther below sea level than any other point in the Western Hemisphere, was named by an early traveler who found its water very unpalatable. The snowy scarp of the Panamint Mountains, culminating in Telescope Peak at 11,045 feet, is reflected in the water

Photo by Josef Muench



▼ A SIDE ROAD winds its serpentine way through Golden Canyon, one of the rugged and bizarre sections near the valley floor

By Ewing Galloway



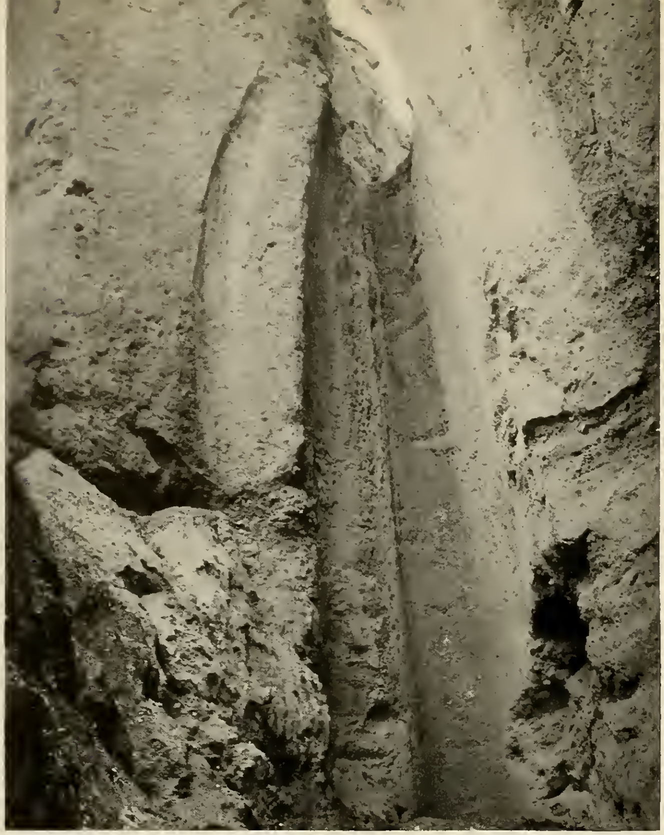
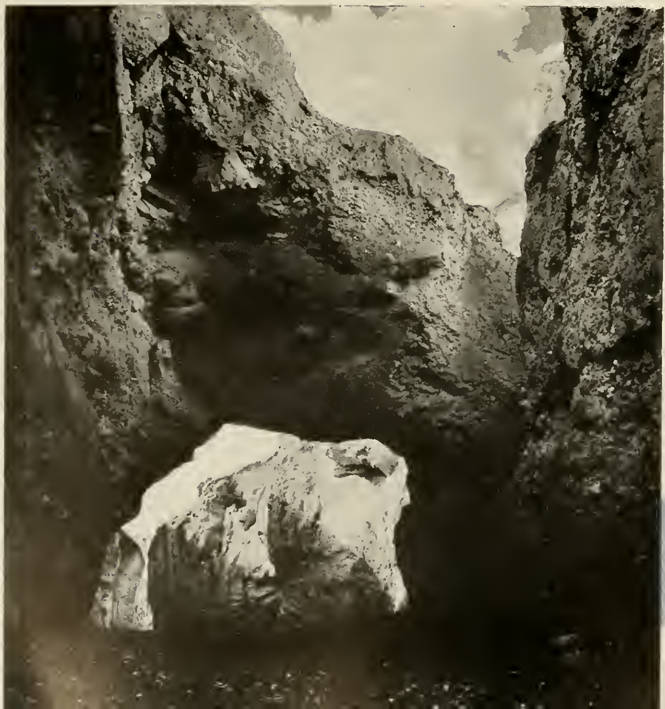


Photo by R. M. Bogg

▲ An extinct waterfall, 50 feet in height: a remnant of wetter days in Death Valley.

Hubert A. Lowman photo



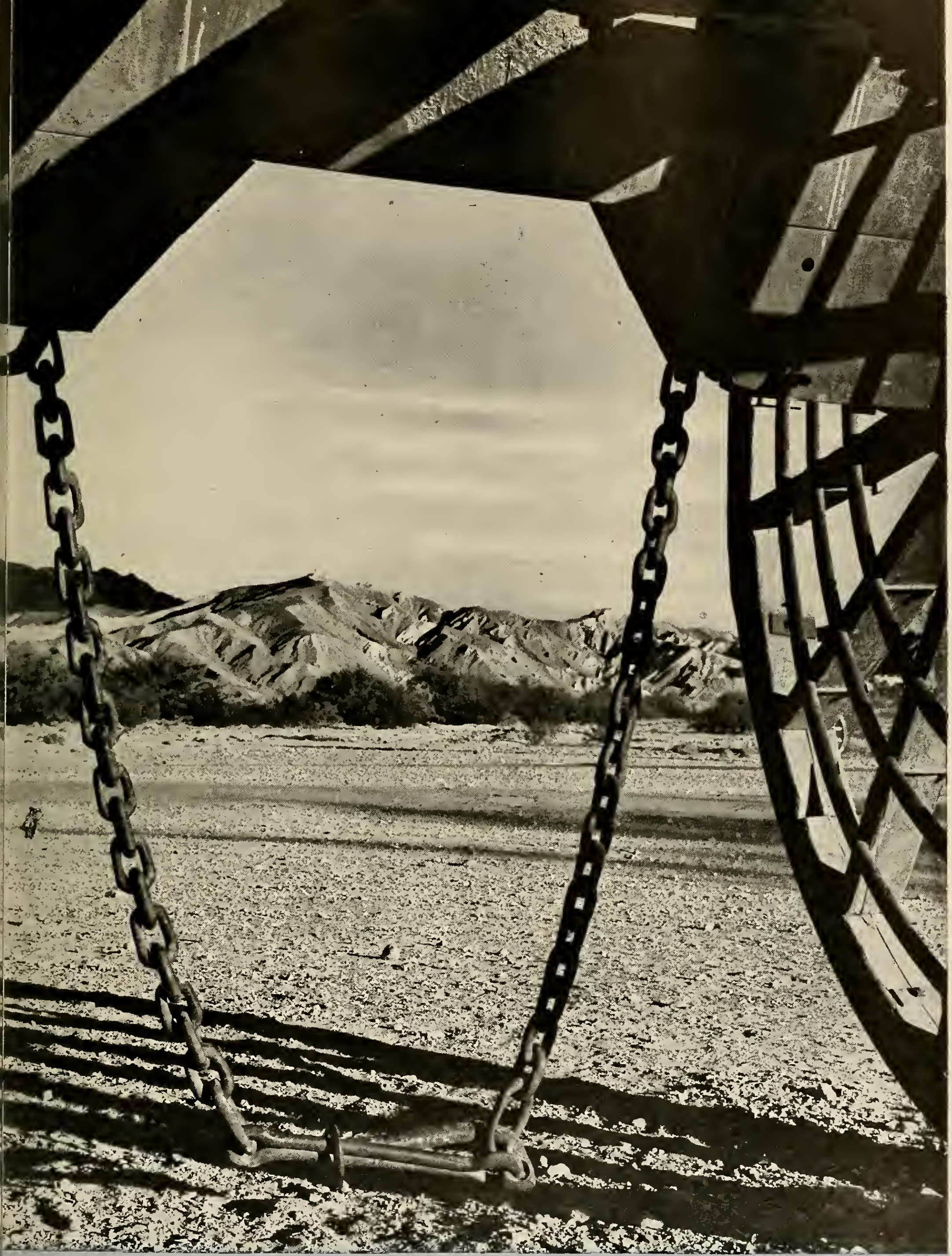
◄ This natural bridge was formed whe water poured over the waterfall shown abo

up the canyon is an extinct waterfall that is even more spectacular than the bridge. Though no water now runs over it, the waterfall must have been 50 feet high. The rock is gouged to a depth of ten feet in a groove ten to twenty feet wide. Possibly at long intervals it flows again, but in late Pleistocene time, when the region was experiencing a humid climate at the close of the glacial period, it must have flowed in quite a torrent.

Another curious sight is the Devil's Corn Field, where bushy growths of drought-surviving desert plants manage to persist like shocks of corn, dotting the salt flat. This weird sight is not to be found in any other southwestern American desert.

Here and there a reminder of Death Valley's troublous early days stops the traveler, such as the burial place of prospectors Dayton and "Shorty" Harris. The marker reads: "Bury me beside Jim Dayton in the valley we loved. Above me write: 'Here lies Shorty Harris, a Single Blanket Jackass Prospector.' Epitaph requested by Shorty (Frank) Harris, beloved gold hunter. 1856-1934. Here Jas. Dayton, pioneer, perished 1898." At the bottom we find: "To these trailmakers whose courage matched the dangers of the land, this bit of earth is dedicated forever."

The writer's visit to Death Valley was thrilling. Leaving Boulder Dam early in the morning, we drove through Nevada's gambling center of Las Vegas and thence on into Death Valley to Furnace Creek Inn for the night. As we arrived, men were unloading twenty big black mules, and movie actors were coming in by autos to stage the desert scene of "Twenty Mule-team Borax." The four-ton wagons used so long ago to haul borax to the railroad near Barstow were outside the camp. The wood-burning steam engines that followed the mule teams were standing near the curious gateway to the Inn, and the colorful movie crowds were milling around the hotel and cabins. Wallace Beery was here, and we saw the salt pool down at Bad Water into which he was to be thrown during the filming of a modern panorama



Paul J. Schoenfeldt, from F. P. G.

▲ Desert logging wheels: one of the many picturesque remnants of man's earlier attempts to master Death Valley. Two sets of the huge wheels were coupled together, and the logs were slung in the chains. Ten to 20 mules hauled the load. Because of the extreme heat, much time was lost trying to keep the metal rims on the wooden wheels

Josef Muench photo

▲ Evening shadows. The incomparable play of light and shadow on the sand dunes in Death Valley comes to an abrupt close when the sun drops behind the mountains. Night swallows first the dunes, then the Funeral Mountains behind them

John L. Blackford photo

◄ "Golden Cathedral" rises like a stately edifice above Golden Canyon, sharp against the deep sky

By Ewing Galloway

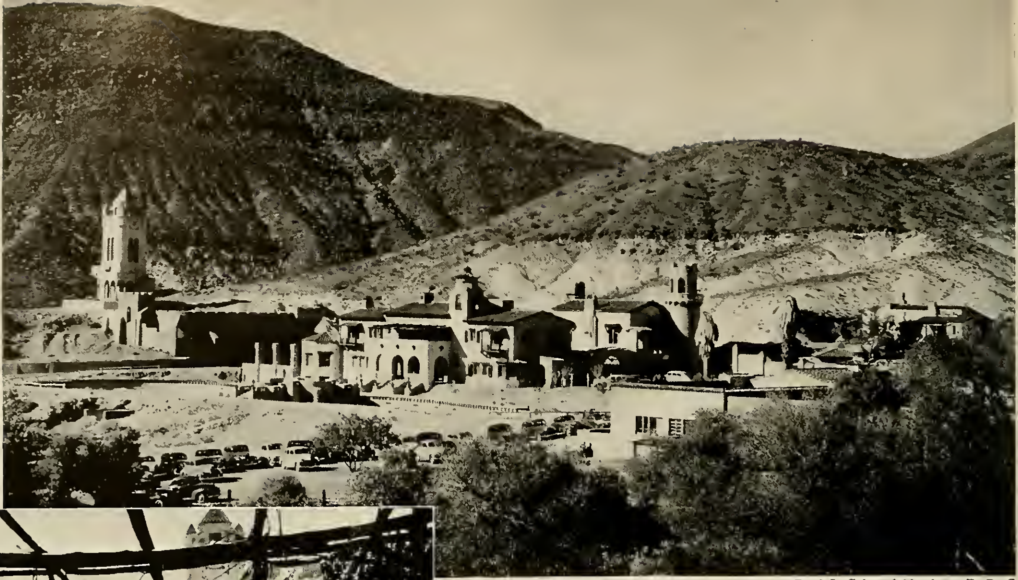
Josef Muench photo

➤ **Shadows on the dunes** are like a turbulent seascape—caught and frozen by the low rays of the sun

Photo by Hubert A. Lowman

➤ **Blazing reds** and yellows run riot in the Golden Canyon section of the Funeral foothills

➤ **The twenty-mule team** became inseparably associated with Death Valley when traction engines failed owing to the quantity of fuel and water required. These are some of the original wagons that the mules made famous



Paul J. Schoenfeldt, from F. P. G.

▲ In a setting so arid and desolate, one is stupefied by the vision of the elaborate castle of Death Valley Scotty and his partner, Mr. A. M. Johnson, an easterner. Hidden springs provide the water for its indoor fountains. Visitors welcoming its cool shade are courteously shown through this man-made wonder for an admission fee

John L. Blackford photo

▲ The patio of Scotty's Castle, looking toward the inner court. Many of the artistic furnishings were brought from Europe, and one almost feels that this remote "kingdom" is a piece out of the middle ages. But there is every modern convenience and comfort. The hot-water system needs no fuel, because it utilizes the heat of the sun

▼ Desert flagstones. In the valleys between the knife-edge ridges of sand, moisture has sometimes collected and dried to form these paving blocks

Josef Muench photo

of a pioneer mining project of 50 years ago.

The mules were driven back of the date palms, which yield large quantities of dates and grow fast when supplied from the big springs. During the evening the Ranger described the wonders of Death Valley. He explained how a piece of iron in the hot sun would sear the hand, much as frost does in sub-zero temperatures, and he told how tires expand and burst unless air is periodically let out as the temperature rises. Even in the relatively cool months of March, our tire pressure rose from 30 to 37 pounds during a morning's run to the Mohave.

If anyone thinks the Badlands in South Dakota have remarkable coloring, he should go to Death Valley. Not even the Grand Canyon can show such shades of color. Black volcanic masses, purple porphyries, and bright red and gray granites delight the eye with their untold wealth of color, along with pink, blue, green, red, and white sandstones. And to one who familiarizes himself with the geology, these colors tell the story of the physiographic changes. Looking over these banded rocks with their rainbow hues from Dante's View and Zabriski Point at an elevation of over one mile above sea level, you can see far below the long white basin of Death Valley filled with evaporated salt beds 15 miles wide and 150 miles long. To the west one gazes at the eternal Sierras and to the east the snowy Charleston Mountains of Nevada.

If ever one should have a color movie camera, it is while driving over this basin. One place is called the Devil's Golf Course, where the salt has lifted in crystalline masses like icicles. By digging six inches deeper at Bad Water, one is 280 feet below the level of the Pacific Ocean, which is only 250 miles away. It seems strange that within the shadow of the highest snowcapped pinnacle in the United States there should be some 500 square miles of subsea basin.

The rainbow colors of the rocks are permanent, but in winter and spring one has the additional display of gorgeous flowers. In February the slopes not far from Bad Water are literally covered with masses of white verbenas, white evening primroses, daisies, and all sorts of other flowers springing up in every gorge and canyon. If one has time to study the vegetation, it will reveal the many interesting ways in which nature attempts to conquer severe climatic handicaps. How so many wild flowers can find root and then spring up quickly in the desert is hard to understand. Their seeds must lie dormant, perhaps for years, before some unusual storm provides the needed moisture. More than 560 species of native plants have been found in Death Valley. Salt usually kills vegetation, but in Death Valley there have developed a few unique plants that cannot grow without salt.[*]

The problem of getting fresh drinking water is, of course, the foremost one in the desert. As late as August, 1940, Dr. J. E. Wolff, 82 years of age, Professor Emeritus of Harvard in Geology, died of thirst and exhaustion in the Mohave Desert. Death overtook him when his car got stuck in the sand. The announcement in *Time* stated: "While waiting death or rescue, Professor Wolff wrote a codicil to his will, leaving a bequest to his gardener." Perhaps death in the desert brought vividly to mind the wonderful gardens of his homeland.

Were it not for the fearful heat and hot dry wind, man and beast would not require so much water. Only those who have experienced desert drought know what the suffering is like. Springs do occur in deserts but only at long intervals. They are to be looked for in margins where rocks begin their uplift and permit water to seep down from higher slopes. Every important spring in the deserts of southern California is known, and routes are marked to desert watering places that they may prevent travelers from perishing.[1] Vegetation is sometimes a clue to water, but one must know his plants, because some send their roots to great depths to tap the subterranean water far below the surface. The mesquite tree and the ubiquitous greasewood

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[*] Fish are even found in Death Valley, in the alkaline waters of Saratoga Springs, 20 miles from Bad Water. They are believed to have survived from the Glacial Epoch, when drainage was different. An article describing them was published in NATURAL HISTORY for September, 1936.—ED.

[1] Water Supply Paper 490 of the U. S. Geological Survey, also numbers 497, 498, and 499.

▼ **A FAMOUS VANTAGE POINT from which to view Death Valley is Zabriskie Point, which presents this chaotic landscape. The jagged eminence at the right is named Manly Beacon, after the resourceful member of a pioneer group that met partial disaster in the Valley. Beyond rise the Panamints, across the Valley floor**

Josef Muench photo

have been known to send their roots nearly 60 feet deep.

Only in dry air can a human being endure the temperatures of Death Valley, which range in summer up through 120° and 130° to an official 134° F. in the shade. Such heat dulls the mental processes, causes fever, and makes one lose all initiative and appetite.

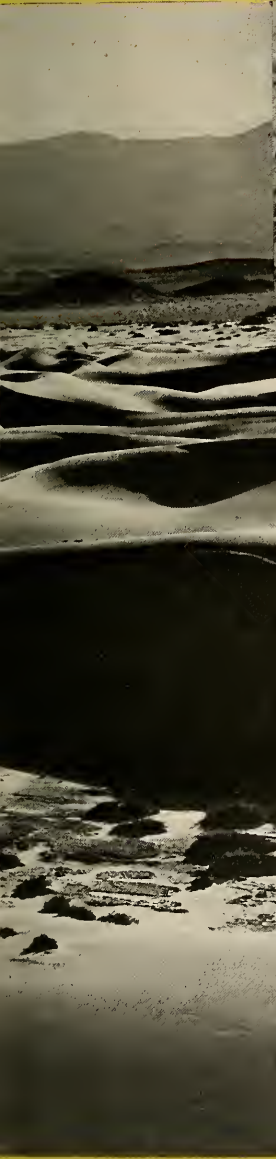
The search for minerals ushered in the modern story of Death Valley, and its name is inseparably connected with borax; but today it is achieving fame as a vacation resort. Here one hears the weird saga of Death Valley "Scotty," who has built a palatial mansion at the upper end of the valley and is supposed to have an unlimited supply of pure gold coming from a hidden mine. Others, probably correctly, say that Scotty's million dollar castle was built with money coming from a Chicago capitalist and friend, Mr. A. M. Johnson, who was once helped in the West by this wandering miner. The mystery goes on, and hundreds and thousands of tourists continue to pay a dollar fee to visit the spectacular mansion. It is a showplace of the first magnitude. The architecture is for the most part a free adaptation of the provincial Spanish. Some of the finest wrought iron in the United States is to be seen here, and many

➤ LOOKING back into the Valley. After ascending the Panamint Mountains to Aguerreberry Point, one can scarcely realize that he is about 7000 feet above the valley floor

Josef Muench photo

DEATH VALLEY is one of the
v places in the United States
ere one can observe the for-
tion of desert dunes

Josef Muench photo



of the rugs, tiles, and draperies are imported from the Old World. There are indoor fountains, and men were brought from Austria to carve great doors and woodwork. All this in forbidding Death Valley. It has been asserted by the owners that the castle cost them two million dollars. Death Valley Scotty himself, whose real name is Walter Scott, spends most of his time secluded in smaller quarters at his lower ranch on the borders of Death Valley, or lingering in desert towns.

The mining of borax, the chief commercial product of Death Valley, goes back to the "twenty mule-team borax" outfit of the early '80's, which mined and shipped out the first borax, near Harmony Mills. This was two miles north of Furnace Creek. The discoverer, Winters, sold the properties to Coleman for $20,000, and this deposit was worked for 20 years.

Not far to the south, at Ryan, lie important beds of borax ore in stratified layers,—colemanite and ulexite—, which have been extensively mined.

There is now only a guard at the Ryan mines, an Irishman, who takes pleasure in carrying tourists around the mountainside in his baby-gauge railroad. The trip takes two hours, and as we wind dangerously around the curves and approach a tunnel 1800 feet in length, the miner calls back, "We'll go through if we don't run off the track." His open cars squawk and squeal on the ungreased rusty rails. The ride is rough for the tenderfoot, and all are wise to hang on when the cars whirl around hairpin curves above a steep precipice. The engine is unique. It is run by gasoline, and the drive is by friction, like the old Carter automobile, which had a big brass disk rubbing against the vertical wheel. It is something of a curiosity, and tourists who want a real thrill can get it on this elevated railroad at Ryan. These older workings have been superseded by the richer Kramer bed in the Mohave Desert, producing kernite (otherwise known as rasorite) and tincal.*

From every angle deserts offer exceptional interest for both layman and scientist. Mining may come and go, but these unique lands of our far Southwest are destined year by year to become better known as places for recreation. Rare is the traveler whose intellectual curiosity will not be stimulated by the weird and wonderful things he sees in Death Valley.

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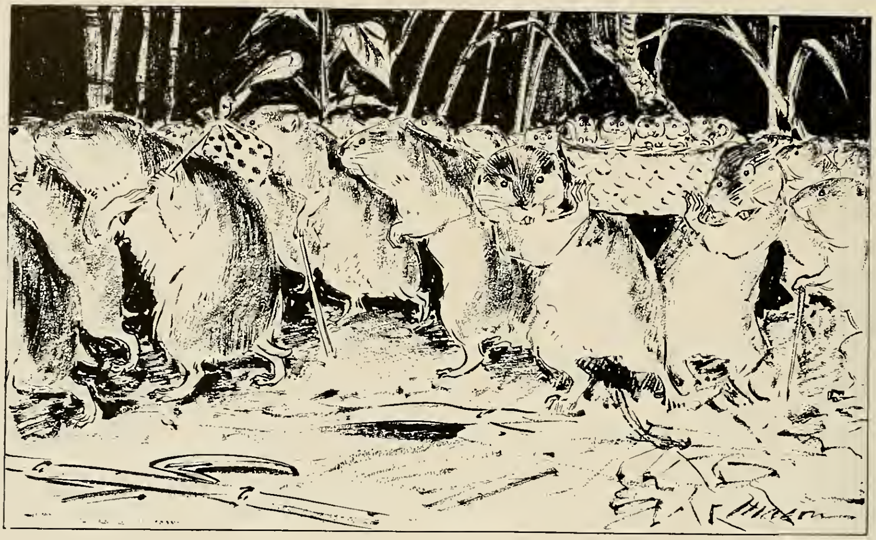
*Kernite enjoys the peculiar distinction among ores in that it produces more end-product (borax) than its own weight. Ten tons of *pure* kernite, if dissolved in water and recrystallized by evaporation, will produce about 13 tons of borax. In actual practice, however, insoluble impurities which are removed from the solution, lower this yield in varying degrees.

LEMMING HORDE*



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

In 1868 a ship was coming into Trondhjem Fjord, Norway. The captain noticed that the water was covered with small brown objects, like fallen leaves, but these on closer inspection proved to be lemmings, swimming out to sea. For fifteen minutes the ship ploughed through the mass of rodents.

Every three or four years the lemmings overrun parts of the Scandinavian Peninsula. They are stout-bodied relatives of our meadow mice, about five inches long, with very short tails. In color they are rusty brown, with a black stripe down the back and yellowish sides. Normally they live above timberline on the mountains or on the arctic tundra, far from cultivated fields, feeding on grass, moss, and dwarf birch. Periodically, however, the lemming population reaches a density far beyond the food supply in their homeland. Since each pair may produce five or six young, several times a year, and the offspring reproduce when only a few weeks old, this is not surprising. The animals that normally prey on lemmings are few—weasels, foxes, hawks, and owls. They do not reproduce nearly so rapidly as the rodents, and once the lemmings gain a head start their enemies cannot catch up with them.

When conditions in their homeland become too severe, millions of young lemmings emigrate, moving down to the valleys and eating up nearly every green thing as they go. The hordes journey chiefly at night, but sometimes they continue their march by daylight. They multiply as they go, but now their destruction begins. Snowy owls and arctic foxes from the high mountains and tundra follow them; skuas leave the seacoast to nest where the lemmings abound; and almost all the animals of the lowlands are their enemies. Even those that usually eat plant food—pigs, cattle, goats, and reindeer—turn carnivorous and eat lemmings. The larger fishes in the rivers and lakes they cross also gorge on the multitude of lemmings.

ON YOUR RADIO

This Wonderful World—Bob Emery and John Saunders.

WOR and the Mutual Network,

April 7, 10:30 A.M.

Curfew Trails—Rita Ross and Julius Postal, by transcription on Maurice Dreicer's "Midnight Philosopher" series.

WWRL, Mondays, 12:15 A.M.

Science for the Seven Million—Lucy Clausen and Julius Postal.

WNYC and WNYC—FM,

Wednesdays, 3:30 P.M.

Science for Freedom—Julius Postal.

WNYC and WNYC—FM, April 5.

Television Quiz—Bob Emery and Julius Postal.

WABD, April 10, 8:30 P.M.

Then disease strikes the lemming hosts, and hundreds of thousands die of "lemming fever," probably tularemia. This is sometimes transmitted to the people of these areas, perhaps through contaminated water. Wells and streams become filthy with the waste products and dead bodies of the rodents.

The survivors, in bad years still to be counted in millions, finally reach the seacoast. They have crossed streams and ponds before and there is nothing to tell them how wide the sea is. Their eyes are short-sighted, suited better to detecting the movements of enemies than to guiding the little animals on their journey. At any rate, the lemmings plunge bravely into the salt water and swim out to sea. The Norwegian lemmings swim toward the west, and writers with more poetic feeling than scientific knowledge have supposed they were urged by instinct to go to Atlantis, the fabled lost continent in the Atlantic. However, those that migrate from Lapland swim north, and the Swedish lemmings swim out into the Baltic.

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*See Elton, Charles. 1942. *Voles, mice and lemmings.* Oxford.

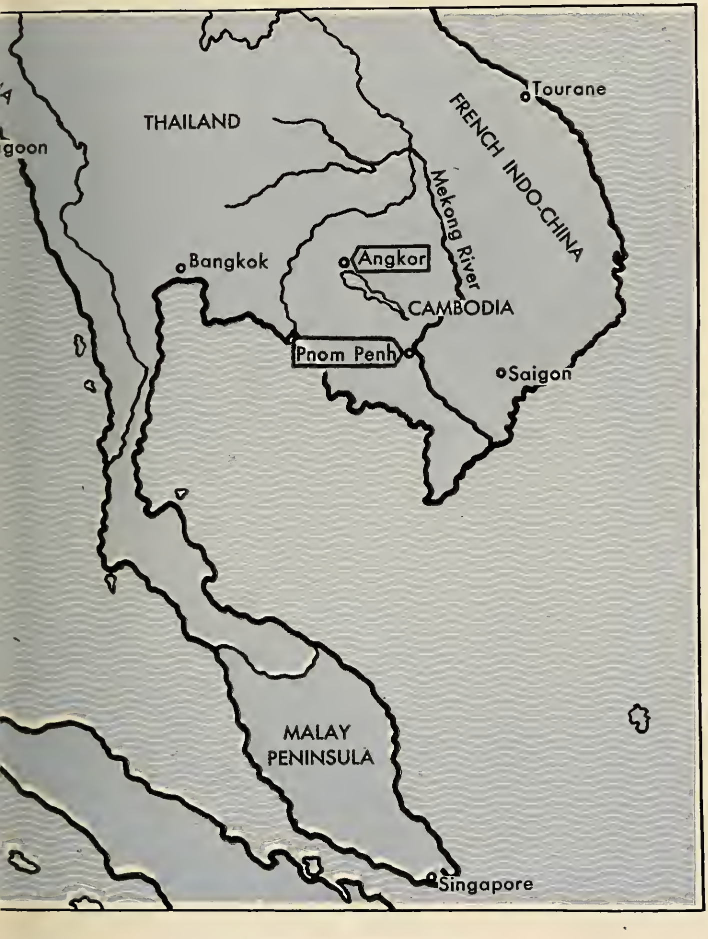
ANGKOR—

ramblings and recollections

To capture the grandeur and mystery of Angkor is to embrace all the elusive beauty of a past that persists and still haunts us today

All photographs by the author

By MARTIN BIRNBAUM



▾ SAMPANS on the Mekong River

LOVERS of Cambodia and its art have been anxiously wondering for the past few years whether the agreements entered into by the Nipponese with the Vichy regime and the Siamese government, have spared the region from devastation. It would indeed be a major war calamity if the Japanese ravaged the temples and jungle bowers where peaceful orange-clad priests meditated on the relative values of their philosophy and the white man's chaotic activity.

Before the war, there were various ways of entering the country, and after my first visit in 1926 I tried most of them. If you traveled by railroad via the Malay Peninsula and Thailand, the tinsel towers of Bangkok left a rather cheap theatrical flavor in your memory, but you might enjoy the opportunity of making a preliminary study of the fine Cambodian or Khmer bronzes and sculptures in the Bangkok museum. There were similar advantages in coming south overland from Indo-China. One motored for the most part over the old Mandarin road, and in the museums of Hanoï and Tourane the cultural remains not only of the Khmers but also of their ancient enemies and neighbors, the Chams, were seen at their best. These two approaches made the traveler realize the enormous influence exerted on the Cambodians by India on the one hand and China on the other.

Our favorite method of travel, however, was by steamer to Saïgon and then by motor to Angkor through Pnom Penh, the seat of the native government. From the sea, the flat reaches of the great delta of the Mekong River took form slowly. As we steamed along the coast, there were no swaying date palms or golden sands, no rhythmic swells breaking on coral reefs as at Tahiti or Samoa. In the fog we hardly knew where the muddy river waters stopped or that

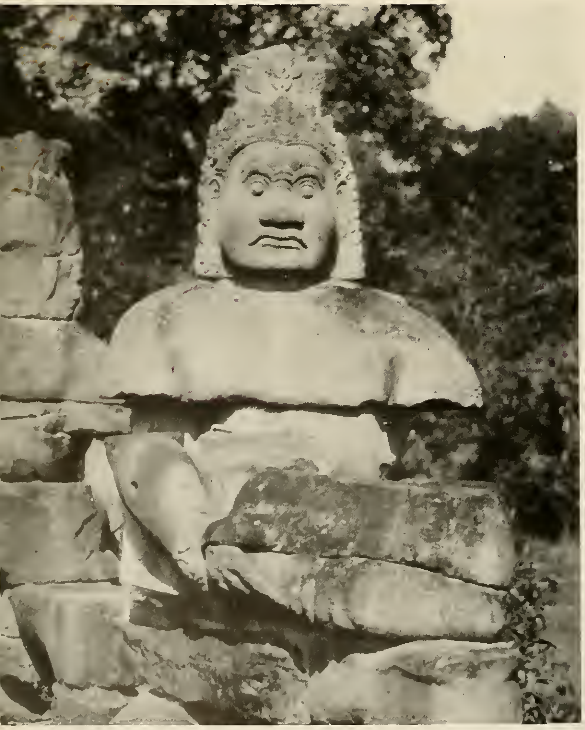
▲ **A street in Pnom Penh,** Indo-China, leading to the monumental tower

we had reached the docks of Saïgon. The wharves were crowded with female coal porters, their heads protected from the sun's rays by broad conical hats made of plaited pandanus strips or dried grasses. As soon as we were made fast, these women were running up and down the gangplanks, their shoulders balancing flexible bamboo poles to the ends of which two heavy baskets of coal were attached. They were fueling the steamer for her return voyage. Their mates, the pestiferous rickshaw boys and other lowly laborers, often slept through the night on the unpaved streets, wrapped in ragged blankets. As we landed, they milled about us in search of customers, and as soon as they found one they ran off, grinning with their human load, to a European hotel.

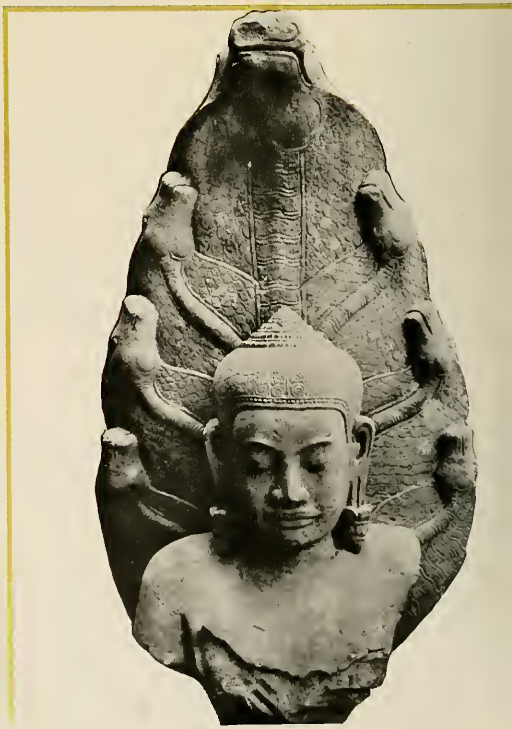
Saïgon is a typical French colonial town, with an ugly Opera House, pretentious government buildings, and cafes and shops, many owned by Hindus, offering familiar European wares. At nightfall the streets, lined with tropical trees, are lively and quite attractive. The fine archaeological museum always held me for a day or two, and I could never resist the zoological garden, even though I strongly resent the caging of wild animals in small prisons. The fauna of Indo-China was well represented,

Notable Sculptures from

▼ **One of the baleful giants** guarding the road into Angkor Thom. The ruined blocks are parts of the body of a gigantic many-headed serpent, or naga



▼ **A dignified example** dating from about the eleventh centur head of Buddha protected by a halo of serpents. Like the other sculptures at right, this piece is in the Metropolitan Museum of



and I had a special friend there. He was a small elephant who "kowtowed" when you threw him a copper, marched off with it to buy a banana, and never failed to return and thank you again before eating it. He was the fruit vendor's best customer, for he was a favorite of the children on school holidays when they came with their gibbons. These pet apes walked almost erect beside their young masters and were remarkably clean. Their behavior was fastidious—I was about to use the word "snobbish,"—and when one of them, clinging to the neck of its owner, deigned reluctantly to shake hands with me, its fingers seemed as sensitive as a musician's.

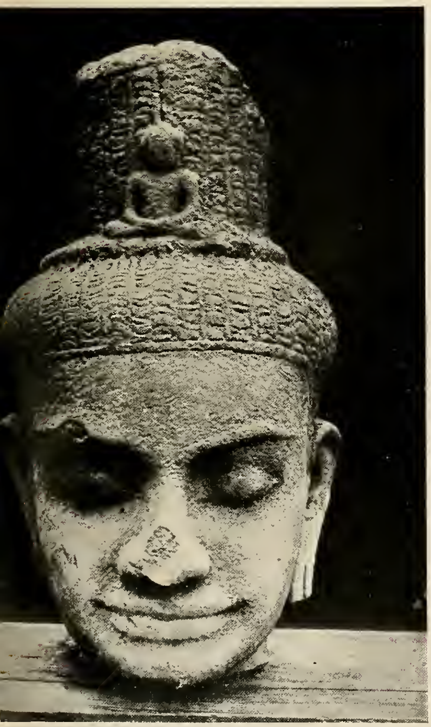
Overland to the great ruins

Soon a car, always old and dilapidated, would be hired for the trip to Angkor via Pnom Penh over a section of the country as flat as Yucatan. The monotony that most travelers complain of, however, was relieved for me by great flocks of birds. Since the Mekong River overflows its banks annually, the region is marshy and forms a natural sanctuary. When I returned in subsequent years, the marshes were in part drained and the neighboring jungle cleared to make way for plantations, and the birds were far less numerous. Wild animals, too, were being driven away. Near the villages we saw water buffaloes hidden in the mud almost to their immense horns, to evade flies and mosquitoes. A watchful bird (the *merle buffle* the French call it) was usually sitting on their backs. When the powerful animals emerged, driven by little children to work in the rice fields, cakes of dried earth on their flanks protected them from insects. Their owners lived in flimsy houses raised on stilts or piles to escape the floods, and when we reached a stream too deep to ford, these natives would ferry us across on primitive floats. Now and then, where a permanent bridge was being constructed, we would stop to watch the trained elephants handling the giant timbers.

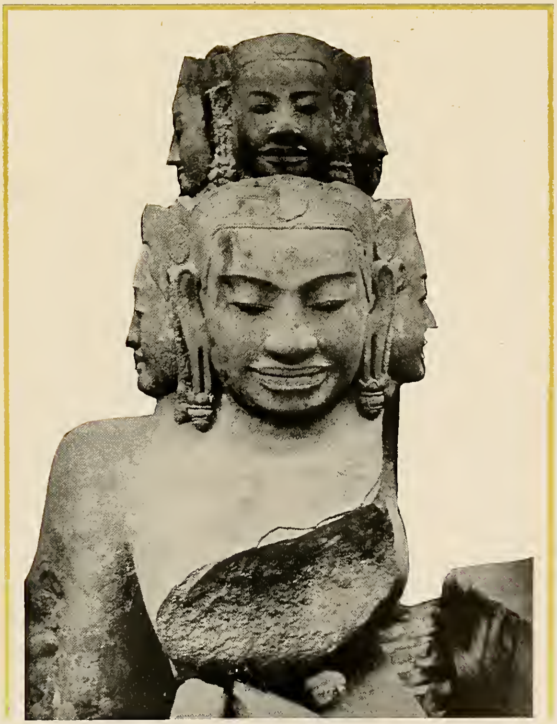
Pnom Penh, the native capital, dominates the plain with its central mound and tower. It usually serves only as a resting place for the night, but its important museum (Musée Albert Sarraut) deserves careful study. Its display of ancient jewels, headdresses, weapons, golden trimmings, animal trappings, and rich textiles arouse one's admiration and imagination. Even more important are the stone sculptures and bronzes, and this museum is the most comfortable place in which to study the vari-

inity of Angkor Thom

▼ A BEAUTIFUL MUTILATED HEAD dating from about the end of the ninth century



▼ THE IMPRESSIVE FRAGMENT of a many headed divinity from the end of the twelfth century, found near one of the gates of Angkor Thom. It had many arms and legs and probably eight heads



▲ HISTORIC OR RELIGIOUS EPISODES are depicted in intricate detail on the walls of the Bayon

➤ THESE DANCING CELESTIAL NYMPHS, or apsaras, are typical of the temple wall decorations of the Bayon

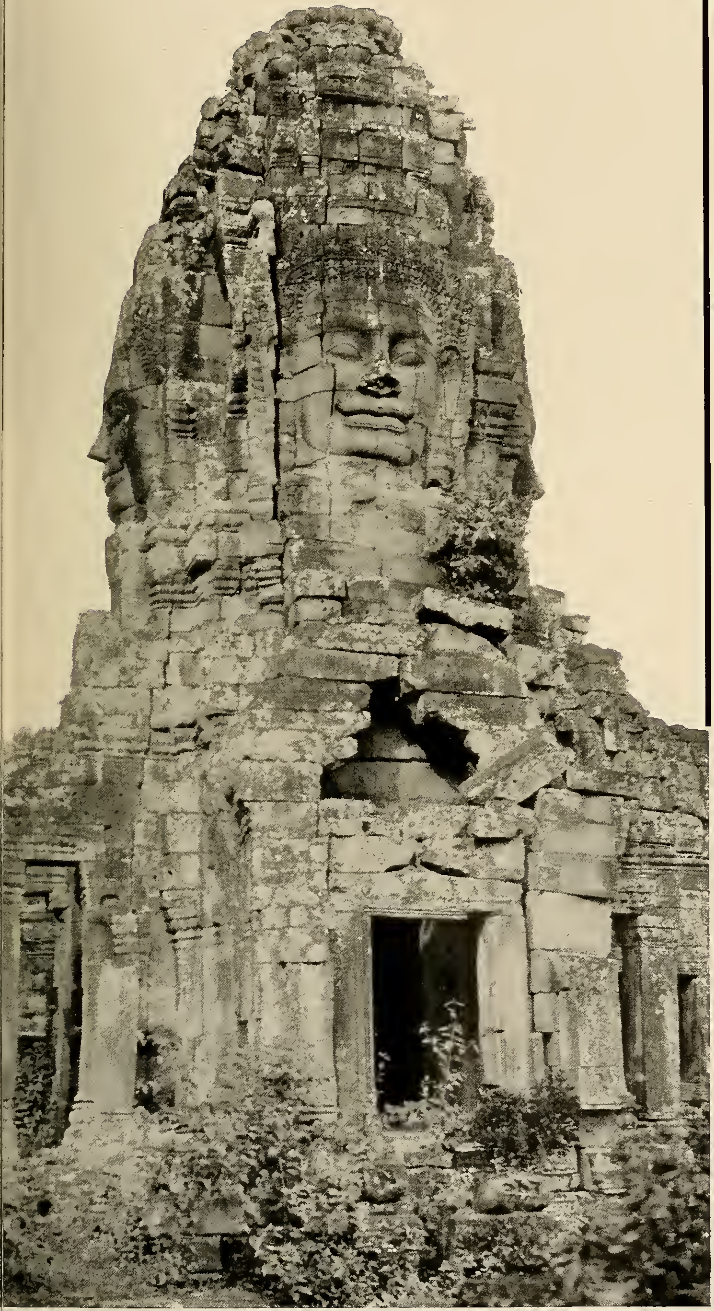
ous styles and epochs of Cambodian art. Guides insist that even the most casual tourist must see the solid-silver-floored room of one of the pagodas containing a life-size standing figure of the Buddha, made of pure gold and lavishly encrusted with jewels. In an adjoining chamber is the "Prah Khan," a magnificent sword and scabbard. It is the finest relic of ancient Khmer lapidary and metallurgic art still preserved, and the blade inlaid with gold is said to be drawn only when the ruler declares war.

Arrival

How should one attempt to describe the grandeur and mysteries of Angkor without seeming to overstate its beauties? Those who lodge at the comfortable hotel a few miles from the ruins have time to unpack and catch their breath. If, however, you prefer—as I did—the more primitive accommodations of the bungalow, you immediately face the imposing pile known as Angkor Wat, and you could not be persuaded to waste a moment indoors.

How vividly I still recall that momentous first arrival! Heavy morning

▼ ONE OF ABOUT 50 similar towers on the Bayon. The four-headed deity may be Brahma



vapor interfered with any clear view of my immediate surroundings, and through a semitransparent bluish haze the memorable vista of sculptured pinnacles took form not far away. When I hastened to examine them more closely, many-headed serpents, fortunately carved of stone, reared up as though to bar my way. Soon the enchanting towers were bathed in torrents of sunlight.

I had been scientifically advised to commence my studies with the earlier and more distant buildings. This meant shutting my eyes to the beauties at my very door and starting off in a flurry for Angkor Thom, the walled city built in part by the great ruler Yaçovarman the First, at about the end of the ninth century. My intelligent guide avoided the nearest of its five gateways and took me to the entrance known as the Gate of Victory. The approach across the dried-up moat that once surrounded the city walls reminded me of the roadways at Karnak lined with stone rams and sphinxes, but here, instead of shifting sand, we walked through the encroaching jungle along a wide paved avenue between rows of about 50 kneeling giants![1] The faces of one line wore a benevolent aspect. The row opposite had round protruding eyes and wrinkled brows and were comically defiant and fearsome. On one of their knees each group supported and held in check the long body of a powerful serpent or naga, rearing its multiple heads. On either side of the gate, gigantic three-headed elephants supported a roof from which a four-faced titanic spirit looked down upon the visiting pilgrim with eyes that pierced all human frailties. Tapering crowns cover his heads, delicate Virgins stand on his shoulders, and other praying female spirits are strung like necklaces around the all-powerful idol's throats. Overwhelmed by your first impression, you pass into the city proper, the "noble capital," or as the modern Cambodians call it, Angkor Thom.

For a long time this was thought to be the oldest town of the region, but the excavations and studies of the learned staff of the Ecole Française d'Extreme Orient had already put us on the right track when the war interfered with their labors. On my last trip to the ruins, I had the good fortune to have as my cicerone,

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[1] Tcheou-Ta-Kouan, the Chinese chronicler of the thirteenth century, says there were 108 figures at each gate.

Victor Goloubew, from whom I learned that the earliest known Khmer architectural remains at Sambor Prei Kuk date from the sixth and seventh centuries. It was not until about the ninth century that the ruler Yaçovarman established himself permanently at Angkor Thom. The excavations and researches of Goloubew, together with the discovery of inscriptions deciphered by Professor George Çoedes, director of the Ecole, proved that the ruined Pnom Bakheng, dedicated to the worship of Siva in the guise of linga, was the real *Mont Central* of a vast quadrangle of which the adjacent Angkor Thom and its amazing Bayon forms only a part. The Pnom Bakheng, with its steep staircases and ornamental guardian Nandins (as Siva's bulls are called), is well worth careful study. However, the strange temple known as the Bayon, built at the end of the thirteenth century during the reign of Jayavarman the Seventh, will perhaps remain the most exciting feature of the region to the average layman.

One must be endowed with the pen of a scientist and of a poetical romancer like Piérre Loti, to describe the Bayon adequately. Coming suddenly upon its remains, which have thus far withstood floods, fires, and the elemental fury of tempests, a modern visitor is overpowered as he stands under a green jungle canopy gazing up at the wierd ruins, which reach a height of approximately 150 feet. How much more strongly moved must have been a superstitious people brought up on the complicated mythology of Brahminism! They may well have worshipped here in a spiritual frenzy, for they believed that the temple had been built by the gods themselves as a terrestrial abode.

It is a kind of step pyramid from the terraces of which approximately 50 gigantic four-faced heads once looked down, each visage about ten feet high from chin to brow, not counting the mukuta or Khmer tiara headdress. Even at high noon when the heat is suffocating and infinite calm prevails, an air of diabolical mystery invests the strange building. When the mists hang low, they seem like poisonous exhalations from the mouths of the enormous images, and it took courage to venture into its nightmare-inducing precincts when night was falling. After a gold and purple sunset, the dreamy mind expects the incredible and the giant features assume a threatening, contemptuous aspect.

The bas-reliefs, carved with notable precision of touch, are gay, eloquent, and lively pictures of the entire Khmer revel of life—their pageants and royal elephant hunts, their wars with the Chams, the fishing parties, wrestling matches, cock fights, dances, and innumerable domestic scenes. However, like the Bayon itself which they decorate, they simply must be seen; and after the war many Americans will doubtless want to journey to this wonderful land.

The more important sculptures in the round, which once stood in the small rooms of the temple, have been removed to museums to save them from vandals, but occasionally new works are still found by the patient excavators of the Ecole. A kind of supernatural agency seems to spur these courageous scientists. One of them, the late Monsieur Trouvé, having discovered an ancient brick temple on the shores of a distant lake, where we used to bathe, found that its central tower was hollow. This was a characteristic of most Khmer edifices, and buried in the debris at its base was a statue of the Buddha, which had been deposed by Hindus centuries ago. Knowing that the principal tower of the Bayon was similarly constructed, he shrewdly suspected that a statue on which some sculptor had lavished his genius and religious passion must at one time have crowned the great building. Trouvé therefore insisted on digging through the deep rubble to the very foundation, and in 1933 his labors were rewarded with magnificent results. I shared his enthusiasm, for this was indeed the discovery of a work of aesthetic importance. All the fragments of a fine Buddha seated on a naga were there, and Trouvé had already put the pieces together when he told me the story. That very year the reconstructed statue, about fifteen feet high, was unveiled in the course of a festival, and the Enlightened One, no longer an outworn idol, was worshipped as of old, before the Brahmans dethroned him.

Exploring the timeless jungle

After you have climaxed a day of wonders in a place like the Bayon, your impressions may be intensified by wandering on the jungle roads among the minor ruins or marvelous structures like the Prah Khan. These are still robed in the fantastic beauty of desolation and decay. Melancholy envelopes you here instead of the ecstasy that thrills you in the light halls of Karnak on the Nile or beside the magical fountains in the dreamy gardens around the Taj Mahal.

It should be pointed out that not only the natural elements and warring neighbors but also the ignorance and carelessness of the Khmer architects have had much to do with the ruin of the buildings, which are not older than our medieval churches. They evaded difficult engineering problems and often used soft rubble as a foundation. They also used wood to support very heavy stones, and when the beams rotted or were eaten by insects, the structure was doomed. Perhaps it would be wise not to attempt to restore Prah Khan but leave it as an impressive monument to the devastation that time wreaks on the work and vanity of men.

Here you are in a fabulous forest in which Arthur Rackham would have reveled. The sun is a thing forgotten in this haunted dreamland. Tall, buttressed tree trunks and distorted branches are almost smothered by murderous clinging vines, and untamed Nature spends herself in an effort to destroy the creations of man. The roots of the false banyans crawl above ground hundreds of feet, like pale pythons, probing the weak spots in the architecture to destroy it. Patches of deep moss and swiftly sprouting fungi, brilliantly colored, cover the prostrate forest giants and ruined fragments. Crumbling heaps of masonry interfere with your progress, and you must move cautiously, because what seems to be a green tendril may come to life as a slender viper. Hairy spiders, mottled toads, lizards, and laughing geckos lurk in crevices from which orchids spring luxuriously. The forsaken shrines—rarely profaned by the feet of even the most daring travelers,—are known to offer sanctuary to prowling black leopards. Now and then the air rings with the terrifying screams of wild gibbons.

One of my most profitable hours was spent among the ruins of the Prah Khan reading a French translation of Tcheou-Ta-Kouan's[2] thirteenth cen-

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[2] A French translation of Tcheou-Ta-Kouan's account by Monsieur Pelliot appeared in April, 1902, in the *Bulletin de l'Ecole Française d'Extreme Orient.*

▲ A PANEL on the wall of the Southern Sanctuary of Banteai Srei

▲ CENTRAL SANCTUARY OF Banteai Srei, with monkey gods as guardians. Note the small doorways

▼ A "TREASURY" OR "LIBRARY" of Banteai Srei with a characteristic false doorway

▼ THE AUTHOR at Banteai Srei examining one of the fallen door carvings

tury narrative describing the gilded Khmer palaces and the sumptuous court life of the time. With this book as a companion in such a retreat you can trace the lives of the ancient Khmers, although the gilded metal casings on their temples have disappeared and the proud race is almost gone.

Sometimes the destructive fig trees reach dimensions paralleled by the ceibas of the West Indies. One celebrated specimen seems almost to have been planted purposely by some prehistoric botanist who knew what its roots were capable of doing. It sprouted on the roof of a small architectural gem known as the Neak Pean, built in the center of an artificial pool. At low water you can see the ever-present stone nagas guarding the steps of the tiny island on which the shrine is built. The roots of the huge tree growing on the roof almost completely hide the building and allow only the doorways and some sculptures to be seen. The spreading branches shade the entire pool to its artificial edge, and should a powerful tropical storm ever strike it down, the lovely temple in its toils will be doomed.

In the neighborhood of these fascinating pools, there are many other ruins offering pleasant hours of contemplation. Chief among these are the vast and wonderful walls supporting the Elephant Terrace, so-named because one portion is covered with a royal hunting scene featuring a herd of life-size elephants. It is also referred to as the terrace of the leper king because the mediocre seated figure of a nude male was found and left there. The spots on the discolored stone probably gave the sculpture its name. Near it are walls, perhaps of underground passages, adorned with row upon row of Brahman spirits, garudas serving as caryatids, and hundreds of personages, human or divine. It is all in keeping with the prodigal exuberance that characterized Khmer art. Few stones were left undecorated, and it was our privilege to secure a group for the Metropolitan Museum, where these[3] and a modest collection of other authentic examples of various epochs may now be enjoyed in New York.

The walls of the immense galleries that enclose each tier or gradin of the pyramidal temples, are covered with bas-reliefs often longer than a city block, interpreting the religion of the builders. They trace the legends in their sacred books, immortalize the wars with neighboring enemies, and depict intimate scenes in the life of the populace. The serene Buddhas, whom the Brahmans attempted to destroy, are found everywhere in a more or less fragmentary state, and they often rival in beauty the Chinese and Indian conceptions. One of these sacred, tranquil figures, known as the Tap Pranam, stands on a broad roadway leading from the terrace of the leper king. This huge idol was for me the untroubled ruling spirit of the entire region. He is all we have left of a Buddhist monastary, founded — according to Monsieur Çoedes—at the beginning of the eleventh century. I enjoyed sitting before him on a tree stump while the jungle murmured its infinite mysteries, with nothing to disturb me except a few prying parakeets.

The Citadel of Women

It is really almost impertinent to write about Angkor in a few pages. However, one small unit or group of sanctuaries no one can afford to miss. It is known as the Banteai Srei, or Citadel of Women. All the winning qualities of Khmer art at its apogee are here gathered together, in a cluster of small elegant buildings some 20 kilometers from Angkor Thom. A stele dated 976 A.D. discovered by Monsieur Marchal in 1936 and the temple inscriptions deciphered by Monsieur Finot establish the fact that the buildings were begun during the reign of Jayavarman the Fifth, in the tenth century. In spite of such evidence, the sculptured details are such an advance on the cruder work at the Bayon, that we believe they were created long after the buildings themselves were started. Technically this art is probably the finest achievement of the sculptors, but the buildings are not highly significant as architectural models. For the most part, they stand on raised platforms, the entrances guarded by monkey-gods, Khmer lions, or other monsters, and there are many false portals and windows without any functional purpose. Some of the real doorways of the small buildings (which, without good reason, are called treasuries or "libraries") are so low and narrow that an adult cannot enter the single room without difficulty. The pilasters and lintels, often telling stories from the sacred books, are particularly fine and may be compared with European works of the Renaissance. Fortunately, one of the publications[4] of the Ecole Française will prevent a visit from becoming a confused fantasy, although the book was printed before the actual restorations were made and some of Monsieur Parmentier's suggestions in the book were wrong and were not followed.

If the Banteai Srei is the most delicate group of buildings at Angkor, the famous Eleventh Century Wat (or Temple) is certainly the most grandiose. Not even the pyramids of Egypt, the Boro Budor of Java, the towering ruins of Yucatan, or the palace of Versailles, can dwarf its architectural grandeur. One should bear in mind that it is only slightly older than portions of Notre Dame de Paris or Westminster.

Its moats enclose structures roughly three quarters of a mile square. Its towers lead one to believe that its architects, like those of legendary Babel, wanted to soar into heavenly abodes to be in direct communication with their gods, or perhaps, like the Balinese, they wanted to furnish their divinities with fitting terrestrial homes. They certainly understood the subtle relation between a vast edifice and the surrounding terrain. The long approaches, guarded by proud nagas, over smooth artificial sheets of water mirroring the column and towers beyond, were planned by a genius. The early system of building a series of platforms decreasing in area to form a pyramid was still used, especially for the central shrine and highest tower, because the principle of the arch was unknown. Very steep stairways connected the tiers and led to the topmost sanctuary. At Angkor Wat, the tremendous area permitted the artist to leave spacious courtyards at different levels, which were the platforms for a succession of higher buildings. Surrounding the lowest plane are corridors on whose inner walls are endless series of bas-reliefs. Around the windows lighting these are dancing apsaras, borders of tiny rearing horses and marching elephants, all framed in lacelike floral conventions.

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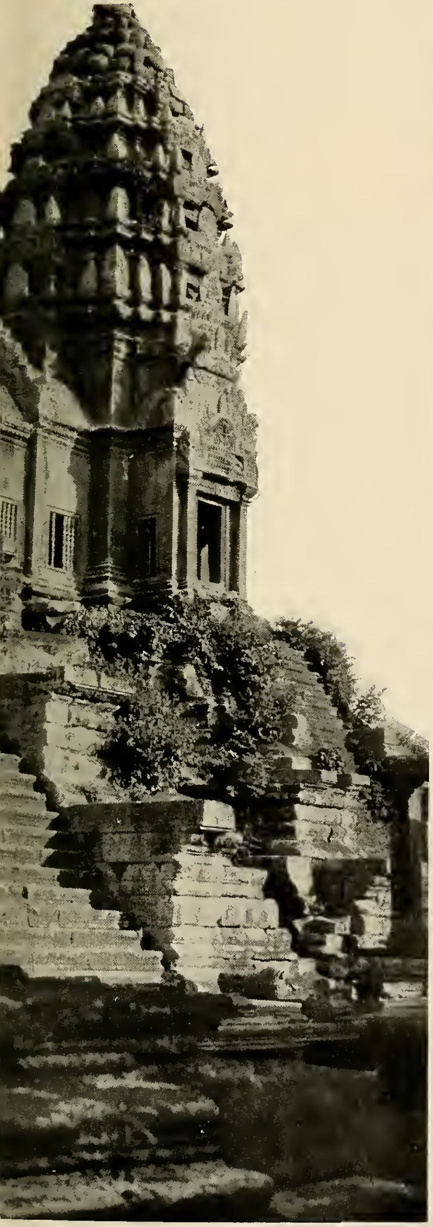
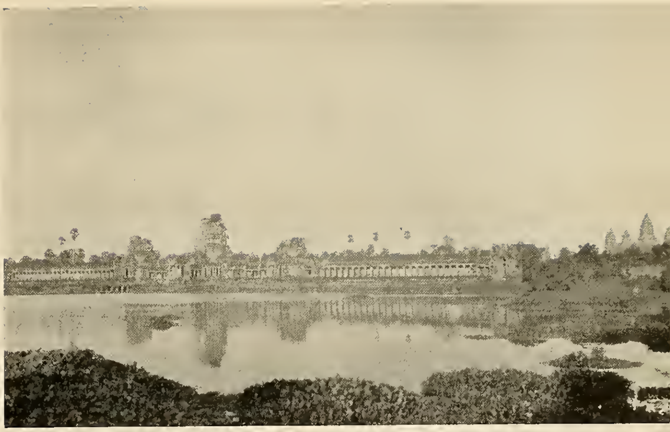
[3] Described in the Bulletin of the Metropolitan Museum of Art, Volume 32, No. 4, April, 1937. A few specimens are at Harvard University in the Fogg Art Museum.

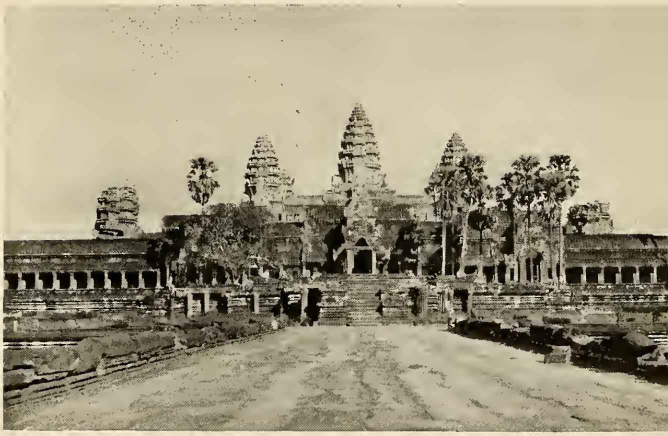
[4] Le Temple d'Içvarapura (Bantay Srei, Cambodge) *par Louis Finot, H. Parmentier, et Victor Goloubew, Paris. G. Van Oest, Editeur, 1926.* Monsieur Parmentier himself, in a later volume, pointed out his first incorrect suggestions for restoring the buildings.

▼ AN INNER TOWER of Angkor Wat, with the steep stairway leading to an upper corridor



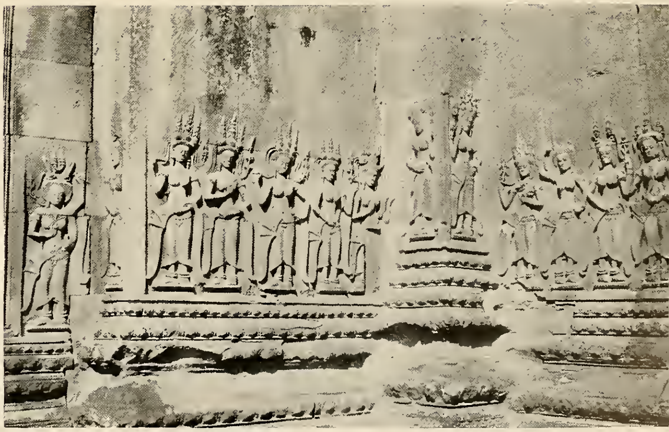


▲ THE MOAT and long corridors on one side of Angkor Wat, with the central towers in the distance at the right



▲ MAIN ENTRANCE to the lowest terrace of Angkor Wat

▼ CELESTIAL SPIRITS on the walls of Angkor Wat, from an inner terrac



Only at early dawn, or when night is falling, can you catch the great temple in its perfect mood. Especially at the solemn twilight hour, the sombre shadows of the Wat cast a spell over me, and a kind of sinister fascination drew me on to wander through its sculptured halls. Ambling slowly about, I was soon rapt in dreams of the departed builders and the strange procession of countless barefooted pilgrims who had worn down and polished the stone floors of these long corridors. I was always thinking of the dead, but on turning a corner in the midst of my speculations, I would come unexpectedly upon a living priest with shaven head, clad in orange and yellow, mumbling his incantations and attuning himself to his holy mission before the altar of an eight-armed image which wore an inscrutable smile. Wads of human hair had been presented to the idol, whose lips seemed to move in the light of flickering tapers, the votive offerings of his devotees. Wreathes of smoke from incense and scented herbs, enveloped the gaunt stone figure. Suddenly, night had fallen. I found my way back to the bungalow, enveloped in the mysterious atmosphere of this strange secretive region, while the moonlight invested the great pile, tower rising on tower, with silvery wonder.

What remains alive

In the winter of 1935, after paying my respects to Prince Thiounn—an important minister at the native court at Pnom Penh,—I went on to Angkor. One evening shortly after, I was informed that the pupils of a former *étoile* of the King's ballet would dance by starlight on a terrace of Angkor Wat, and I was expected to attend. The Prince was a great dance enthusiast, and I prepared myself for the performance by reading his fascinating book on Cambodian dances,[5] a copy of which he had given me.

Long before the pantomime commenced, indistinct figures, attracted by the promised spectacle, began to collect on the causeway leading to the main entrance of the Wat. It was a strange, amber-colored crowd, most of them natives from the neighboring village of Siem Reap. When the play was about to start, the children arranged themselves in a large uneven semi-circle and served the purpose of footlights, for each child held a flaming torch. The silhouette of the gigantic temple and its central tower arose out of the obscurity as an imposing backdrop.

Next to me was the beardless waxen face of an emaciated being, apparently sent to supervise the proceedings. He might have been a eunuch in charge of the ruler's concubines and dancers, for the most gifted and attractive young virgins were destined to play a role in the royal palace. All the performers were girls trained in the great traditions of past generations, and each was submitting herself to a discipline as rigorous as that demanded of the ballerinas in the Russian Imperial Ballet. The girls can move swiftly with exaggerated life, or rise slowly, balanced on one foot, as if floating on air like the thousands of heavenly apsaras carved on the temple walls. As a matter of fact, their exercises, the requisite body massages, their costumes and coiffures are all shown on the bas-reliefs of the neighboring ruins.

The plays, usually based on episodes from the Ramayana and other sacred texts, are familiar to the audiences. They are relics of a magnificent past, reflecting the very soul of the dwindling race, its moral sentiment and religion. The sumptuous robes and blazing jeweled crowns of the heroes surpass the most gorgeous occidental stage trappings. The young mimes and dancers performed in a kind of trembling atavistic ecstasy or orgy. Their controlled movements, the symbols formed by their fingers and supple wrists, the heavy march of the baleful giants, the awkward actions of the monkey gods, the magical flight of genii through the air,—all these were clearly understood by the onlookers, who followed the thread of the story with reverent interest. Mystery hovered over the prepossessing troupe, clothed in sparkling stars and fabrics of golden gossamer, and it was not difficult to imagine how resplendent the court life of King Indravarman and his successors must have been.

The nearest approach to an actual ancient pageant that I witnessed was the celebration of the lunar festival at Pnom Penh about the middle of November, when the waters of the Mekong River recede. His majesty, the late King Sisowath—then about 85 years old—sat in a temporary throne room erected on the bank of the great stream. He was borne there on a gaily decorated litter by eight bearers wearing gold and plum-colored turbans, and he was protected from the sun by ornamented umbrellas. Beside him was his chief consort, while the lesser wives, concubines, and children belonging to the strange royal household, were huddled together in a brilliantly painted dragon-shaped barque, anchored in the river at the foot of a stairway leading to the throne room.

At frequent intervals, one of the women, accompanied by her child, would crawl prostrate on hands and knees up the stairs, and would be rewarded with a casual nod from the white-haired king, who wore dark goggles. I was more fortunate when presented to His Majesty, for I stood erect and was honored with an exceptionally long corona corona. The whole scene reminded me of the now famous Siamese diaries kept by Anna Leonowens at King Mongkuts's court. Many long rowboats, each containing about 30 oarsmen and some comedians, raced up and downstream entertaining the courtiers and populace on the river bank. Their clownish antics and shouting seemed to make everybody happy, but the festival was a far cry from the breathtaking beauty, excessive opulence, and sensual background described by Tcheou-Ta-Kouan.

The struggle of two overlapping religions,—the cult of the Buddha and the followers of Brahma,—must be understood to trace the decay of these people. The Chams and the Thais, with whom they always had to contend, also helped to sweep them from their bearings. By the end of the fifteenth century, we find them driven as far south and east as Pnom Penh, but even then their humiliation did not come to an end. They were still victims of incursions by their Annamese neighbors, and a final debacle was prevented only as late as 1864, when France interfered on their behalf. What has happened since Japan assumed virtually complete control remains to be seen. Their history is only additional proof of the ephemeral nature of human activity and of the lessons taught by time.

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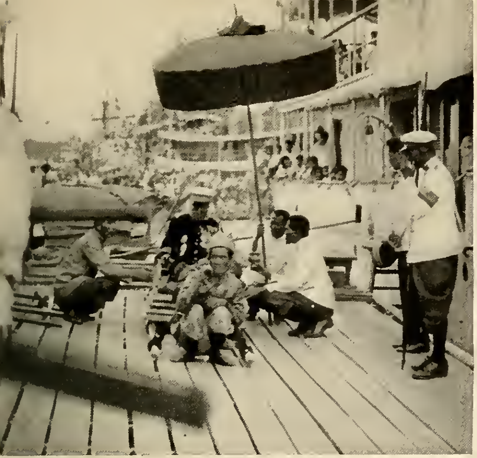
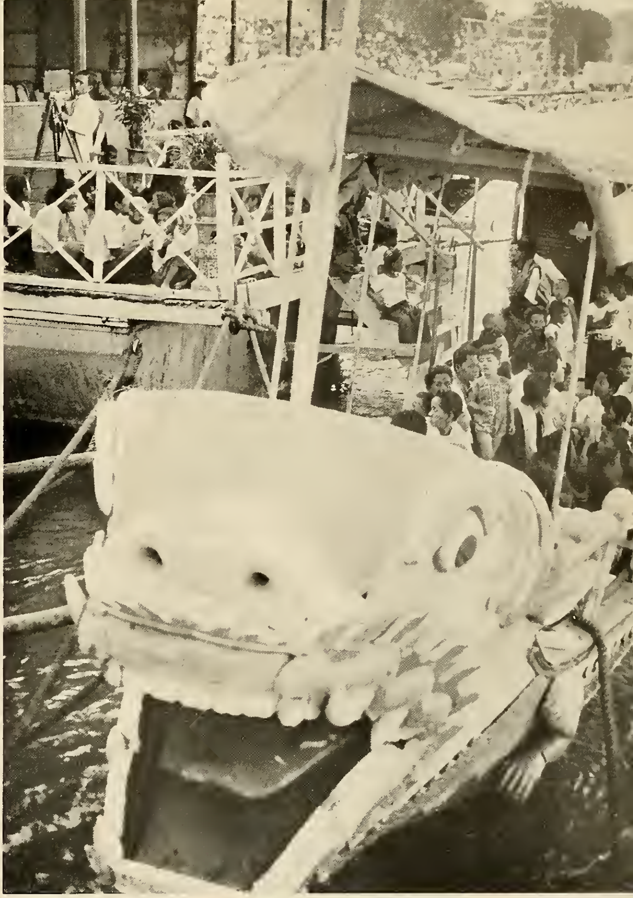
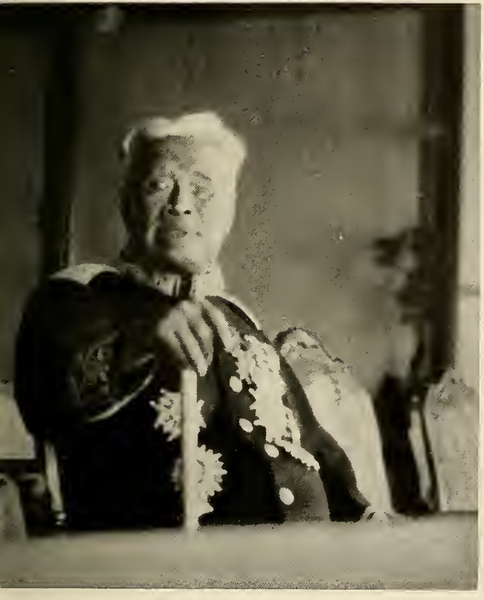
[5] Danses Cambodgiennes d'apres la version originale du Samdach Chaufea Thiounn, Premier Ministre du Gouvernement Cambodgien. *Revue et augmentée par Jeanne Cuisinier. Illustrations de Sappho Marchal. Preface par M. P. Pasquier Gouverneur General de l'Indochine. Bibliotheque Royale du Cambodge.*



▲ THE LATE KING SISOWATH, leaving for the mid-November river festival at Pnom Penh



▲ CONCUBINES AND CHILDREN of the royal household in the dragon boat: a scene at the lunar festival at Pnom Penh, which reflects some of the pageantry of the ancient days



◀ HIS MAJESTY ensconced in the temporary throne from which he witnessed the pageant that is held at the time when the waters of the Mekong recede

▼ A RACING BOAT at the Pnom Penh festival

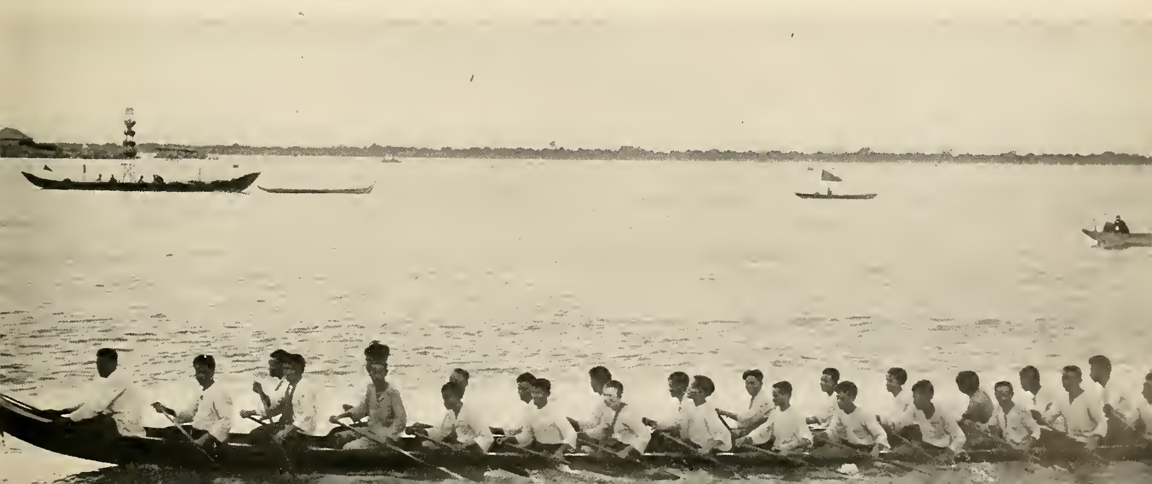


PHOTO SUPPLIES

If you're short on photographic paper!

By THANE L. BIERWERT

Acting Chief, Division of Photography, American Museum of Natural History

ONE square inch equals 500 square inches of photographic materials today. In other words, for every gross of paper you bought five years ago, you will now be able to buy only one-third of a sheet. Small wonder that the amateur photographer suffers when 89 per cent of the entire production goes to the Armed Forces and the remaining 11 per cent must be spread over war industries and other priority-rated photographic users. What can the amateur do with the little that is left?

We could cease our photographic activities. But the number of salons proves that the American hobbyist does not give up easily. We will keep on going even if we have to do things the hard way.

The enlarging paper that we can purchase may not be the brand, the surface, or the contrast that we wish to use. Take it. Ingenuity and experimentation on our part will make the prints.

If the paper has an unknown degree of contrast, or if we are not familiar with its developing characteristics, a test should be made. Select a negative whose performance on enlarging paper is well known. Let us say that it will print with 15 seconds of exposure on No. 2 paper and develop in 110 seconds. From the new package, remove a sheet and trim off a strip about one inch by four. This is our *test strip.* Having adjusted the enlarger to the right position for size and with the lens aperture set correctly, we are ready to work from the known to the unknown. Lay the test strip on the enlarging easel where it will receive both high light and shadow areas projected by the enlarger. In one hand hold a cardboard, larger than the test strip, with which to cover up one-inch sections of the paper. Begin with exposure of 10, 15, 22, and 32 seconds, covering up more of the paper at each interval. Develop the strip the normal length of time, approximately 90 seconds. On inspection of the test, you will know what sort of paper you have. If the print is tremendously over- or under-printed, a new strip should be made, decreasing or increasing the time. If you prefer, you can close or open the lens aperture and use the same exposure times. When a good result has been attained, write on the package that the paper is comparable to No. 2, or contrastier or softer, and also indicate how much more or less printing time it requires than the paper with which you are familiar.

This method gives us more information about the printing characteristics of negatives and paper than any other system or aid, unless we use whole sheets of paper as test strips, which we cannot do this year. Sometimes a negative has such a wide range of tone values that you may want to print certain sections longer than others. If so, test widely separated areas as described above and determine the proper range of exposure.

A quick way of finding the exposure time for enlargements that do not necessarily have to be excellent in quality is to use the darkroom safe-light illumination for your guide. After arranging the composition on the easel, slowly close the lens diaphragm until the highlights on the projected image disappear. Make a test strip. The best exposure can then be used as the correct exposure time whenever that type of paper is used under the same darkroom illumination, no matter what degree of enlargement or how dense or thin the negative (provided the negative is of the right quality to fit the paper contrast). Be sure that your eyes are accustomed to the dark before making this test.

If we have difficulty determining whether a negative is flat or contrasty, dense or thin, we can purchase a negative chart. We lay the chart over a light box, and match our questionable negative with a similar negative on the chart. The chart is designed so that we can specify the contrast of paper on which our negative should be printed and determine whether the exposure will be long or short.

Some negatives will require softer or contrastier paper than the kind we have on hand. We cannot change the inherent contrast of the paper, but we can change the quality of our developer. When more contrast is needed, we can use a less dilute developer. Mix one part developer with one part water, instead of two parts water; or use the solution undiluted. Full development of the print will always render the shadow areas darker. A pre-soaking of the print in pure water for two or three minutes tends to give a pleasing softness to an otherwise too contrasty paper. If we require softer prints, dilute the developer with four to eight parts of water. Of course, all this experimentation will be carried out with test strips, each marked on the back as to what sort of juggling it has received. When conducting these experiments, keep the development times to the standard, otherwise there will be too many variables. Once we have mastered the simple rules, we can do what we please with developing times to achieve the best results.

If we bought glossy paper and had wanted matte paper, squeegee the prints onto sand-blasted glass or coarse groundglass for the desired surface. Be certain that the paper is in intimate contact with the surface of the glass, because air-bells will make very shiny spots, necessitating re-squeegeeing the print.

Matte surfaced papers can be made more lustrous with the application of a prepared print lacquer or varnish, Syn-Var, clear Duco or Bakelite, or a clear floor varnish.

Single-weight printing paper can be built up to the thickness of double-weight by mounting it on a light card or on a discarded second print.

If you want double-weight paper to be single-weight, that's *your* problem!

If we knew of a good paper stretcher on the market, we would certainly recommend it for your use during this critical shortage!

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

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LETTERS

SIRS:

This is to give you my appreciation and congratulations on the quality of your popular journal NATURAL HISTORY, and especially on your wisdom and good fortune in presenting to your readers such socially significant and informing articles as Dr. Shapiro's "A World Full of People." Shapiro's text is excellent but the well-designed illustrations more than double the value of the article, I suspect, for the typical lay reader.

This is not the first time I have expressed my enthusiasm about your journal, but I doubt that I am repeating myself to you, for I have no recollection of addressing the editor previously. With these words of appreciation I send you also my very best wishes for the increasing value and success of the publication.

ROBERT M. YERKES,
The School of Medicine,
Yale University

New Haven, Conn.

* * *

SIRS:

. . . Mr. Partik's short article entitled "Fishing for Bats" brought to my mind an amusing, and somewhat similar, episode that occurred about fifteen years ago. At the time, I was making a short stay in a small town on the Western Slope in Colorado. Each evening four or five of us would motor up an appallingly steep and rugged road to a large artificial lake-reservoir on the mountain, where we would fish for an hour or two, just at sunset, for the fine, large trout that awaited us there. On the evening in mind we were fishing at the inlet of the lake, and doing very well indeed.

Dusk had fallen when numerous bats made their appearance, darting around on all sides of us, no doubt feeding on the evening hatch of flies that was causing the trout to rise. There was ample room for long casting and I was using perhaps 25 yards of line. On one back-cast I found it difficult to retrieve my cast. At first, I thought my fly had caught upon a twig or a grass blade, but, upon turning to free it, I was amazed to see the leader and several yards of my line floating through the air, attached to a bat. I reeled in my line and, with some difficulty, eventually captured the bat. I found that the fly-hook had become fastened in the wing membrane near the tip of the wing. I suppose that the bat had attempted to capture my fly just at the moment when the forward spring of my rod tip had reversed the motion of the fly, upsetting Mr. Bat's calculations and snagging his wing tip. By the light of a flash we succeeded in freeing him, and he fluttered away into the night. Needless to say, I received considerable "ribbing" from my companions on my prowess as a "FLY" fisherman.

HARRY H. MILLER.

Billings, Montana

SIRS:

Let me first tell you how much I enjoy NATURAL HISTORY. It replaces in a great measure both the exhibits and lectures that interested me so much when I lived in New York, and also the long country walks I am no longer able to take.

When I saw people could ask questions that received competent and detailed answers, I thought perhaps I could ask about something I saw far away and rather long ago.

I was walking on a cliff on the northern coast of Brittany. I saw, perhaps half a mile at sea, two porpoise-like creatures, moving with the usual rolling motion, half out of the water. They were much larger than porpoises and snow white. I watched them a long time. From the cliff, I could see their entire bodies, above and below the water. They were an enchanting sight. Then, a little farther, I came to a narrow, deep cove with perpendicular sides, and there, under my very feet, perhaps 50 feet below, was one of the creatures. It was fishing, making quick darts forward to catch, I thought, fish that it had cornered in the narrow cove. It was about twelve or fifteen feet long, gleaming white with a sprinkling of tiny black spots that evidently didn't show at a distance. It had a fairly tall pointed dorsal fin. A local fisherman said the creatures were belugas, which had come after the sardines. But I had seen belugas in the Saint Lawrence and remembered their broad finless backs. A boy who was having science at school thought he had found out what the creatures were: grey grampus. But, back in New York, I saw grey grampus at the museum. They are far too spotty. I would like to know what my glorious white creatures were—grampus, probably, but certainly not the grey kind.

If somebody has the kindness to answer my question, I shall certainly be grateful to him.

JEANNE GIRARDET.

Pittsfield, New Hampshire

George G. Goodwin of the American Museum's Department of Mammals answers this inquiry and offers the accompanying illustrations, useful in identifying whales and their allies:

The observation and identification of seagoing animals in their native element is at best limited to a few brief moments. Trained observers look for outstanding specific features such as the shape and position of the dorsal fin, which may be placed forward, in the middle, or well back on the back, and the shape of the head, whether rounded, pointed or beaked, forehead high or low. The size, color, and markings are also important to determine the species. From the facts presented in Miss Girardet's interesting and colorful narrative we can narrow identification down to two species.

Continued on page 238

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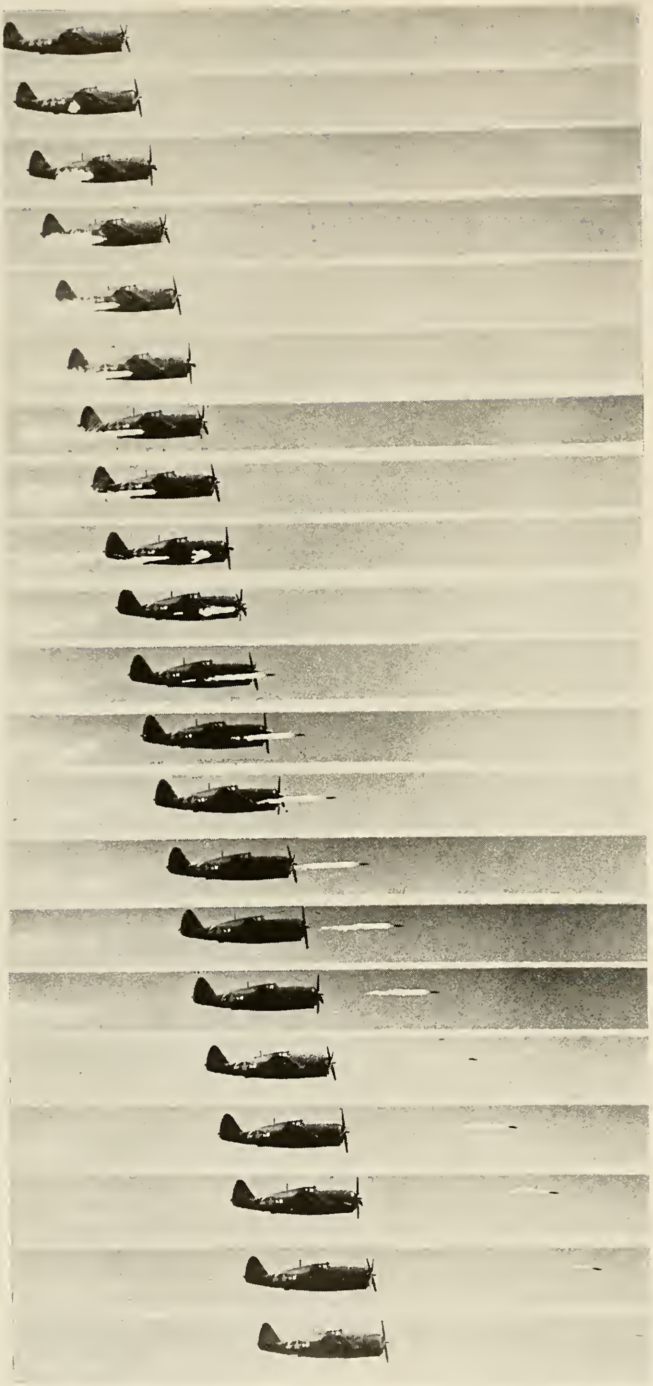

Succession pictures taken by a "ribbon frame" camera, showing a wing rocket getting under way and speeding toward the enemy at about 13 miles a minute. This camera was developed by Bell Telephone Laboratories.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LIV—No. 5 ★ ★ ★ ★ **MAY, 1945**

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THE COVER THIS MONTH

The mushroom commonly known as the Fly Agaric (*Amanita muscaria*), portrayed on this issue, is reproduced from a Kodachrome that is an expression of the photographic artistry of Henry B. Kane.

The "Deadly Amanitas" are among the many varieties of poisonous mushrooms, commonly known as "toadstools." Anyone who supposes that a poisonous mushroom is one that will not peel easily should note that *Amanita muscaria* will do so just as readily as the wholesome and delicious Meadow Mushroom, even though it is decidedly in the inedible class. Even more poisonous than *Amanita muscaria* is *Amanita phalloides*. However, the poisonous Amanitas are not easily confused with their edible relatives if care is taken. Definite knowledge of the distinguishing characteristics, as outlined in any of the authentic books on mushrooms, must be the basis of safe mushroom gathering.

Most active among the complex of poisons in this mushroom appears to be muscarine. Its action on the nervous system is rapid and, in severe cases, fatal. Physicians sometimes administer atropine as an antidote.

This photograph of the Fly Agaric was taken early in July at the edge of a wooded area in southern New Hampshire.

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OURSELVES UNBORN

- - - - - - - by George W. Corner

Yale University Press, $3.00
188 pages, 8 plates, 18 figures

THIS book contains the substance of the twenty-first Terry Lecture Series on "Religion in the Light of Science and Philosophy," given at Yale University in 1944. The author is Director of the Department of Embryology of the Carnegie Institute of Washington and Professor of Embryology in Johns Hopkins Medical School. He presents here the latest information on this subject in terms that those in other fields can understand and assimilate, but it is assumed that the reader will learn as he or she goes on in the book. The excellent illustrations have been chosen to clarify points difficult to explain in the text; they are clear and well labeled.

The history of the individual from the single cell the size of a particle of dust (barely visible to the naked eye), through cell division and implantation, to birth, is told in interesting language. During this development the organism increases two billion times in size. About the third week of life the heart begins to beat. Before this the brain has begun to form, and several weeks later the limb-buds appear. Gradually the various organ systems develop, the structures needed to survive in life after birth.

The nourishment of various types of mammal embryos and the different kinds of placentae are described. Prenatal "influences are exposed as mythical; on the other hand, the dangers of virus diseases, even mild ones, are real. The risks and vicissitudes of the unborn are such that only about one out of three survives to birth.

The evidences of embryology on the relationships of man with other mammals are also fully discussed. The conclusions agree with those from other fields remarkably well and they are stated with an objectivity and clarity highly commendable.

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SEEING THE INVISIBLE,
The Story of the Electron Microscope

- - - - - - by Gessner G. Hawley

Alfred A. Knopf, 1945, $2.50
195 pages, 71 illustrations

HERE is an up-to-date story of the electron microscope, planned and written particularly for the layman. The author leads up to his subject by an elementary and clear discussion of the optical principles of the simple microscope or hand-lens, followed by an explanation of the compound microscope. He then describes the electron microscope,—what it is, how it works, and how it was developed. In non-technical language, he describes its accomplishments in the field of industrial research and in medical science.

In two most important war-industry problems, namely, synthetic rubber and metal surfaces, the electron microscope has already proved a most useful tool in research. By means of the electron microscope we are able to see for the first time how the active principle of serums and vaccines attack disease "germs,"—bacteria and the much smaller viruses; how the white corpuscles destroy bacteria; and something of what happens to disease-producing bacteria when one of the sulfa drugs or penicillin appears on the scene.

"The average human eye can distinguish no objects smaller than 1/250th of an inch in any dimension; the optical microscope—by which is meant any microscope that utilizes natural light—can penetrate down to 1/125,000th of an inch, which is about 500 times the acuteness of the eye. With the electron microscope, particles as tiny as *one ten-millionth* of an inch can be detected. Thus it is about 100 times as powerful as its nearest rival, the ultra-microscope, and no less than 50,000 times as potent as the unaided eye." Furthermore, "The superiority of the electron miscroscope lies in the fact that pictures taken with it have inherently much more detail than optical-microscope pictures." The book contains more than 70 illustrations, many of them amazing photographs made with the electron microscope,—photographs supplied by General Electric Co., Columbian Carbon Co., R.C.A. Laboratories, Dow Chemical Co., and other sources.

CLYDE FISHER.

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field and laboratory approaches to investigations of animal behavior won him an international reputation and a position as Curator of the Department of Experimental Biology in the American Museum of Natural History. The book is based largely upon Dr. Noble's scientific publications, lectures, and unpublished notes. Because she was closely associated with many aspects of her huband's scientific work, and as a result of her own professional experience as Assistant Curator in the Museum's Department of Education, the author is peculiarly well qualified to bring together many valuable observations and conclusions which Dr. Noble himself was unforunately prevented from assembling in final form for publication.

As stated in the foreword the book is intended as an informal introducton to the subject of animal behavior, and is not presented as a textbook or comprehensive reference source. Some of the most charming and interesting chapters are those dealing with the field studies and experiments that were conducted jointly by the author and her husband. The interjection of personal adventures, and the generally informal narrative style lend easy readability. The sections dealing with sex recognition, courtship, and social rank are particularly stimulating, and will undoubtedly hold the interest of any reader.

The book is supplied with a number of photographs illustrating animal reactions, and the general excellence of the pictures is so great that one only wishes that more had been available.

A bibliography of 102 titles is appended so that those who wish to delve further into the technical aspects of the subject may consult the proper sources for more detailed information.

The reader who is anxious to become acquainted with currently accepted methods of objective investigation into animal behavior, desirous of learning about the interesting things that animals do, and at the same time is unwilling to labor through highly technical presentations of the subject will find in this book a great deal to reward his attention.

F. A. B.

SOUTH AMERICA CALLED THEM

- by Victor Wolfgang von Hagen

Alfred Knopf, $3.75
311 pages, 32 illustrations

THIS book represents a dramatic treatment of four leading protagonists in the scientific exploration of South America. Its period extends from 1735 to 1864. The motives of its principal characters were totally different from the thirst for "gold and souls," which had led during two preceding centuries to the conquest and partial settlement of the continent.

Dr. von Hagen's heroes are La Condamine, leader of the first scientific expedition to South America, who measured an arc of the meridian in Ecuador with the object of determining the precise shape of the earth; Humboldt, foremost among traveler-naturalists, who, in the words of Bolivar, "did more for the Americas than all of the conquistadores;" Darwin, whose four years in South America were ultimately responsible for the discovery of a mechanism to explain the process of evolution; and Spruce the pioneer collecting botanist of the South American tropics.

In the scale of greatness or genius, these men are by no means of equal rank, and the author makes no attempt to rate them as peers. He does show, however, that they form a natural sequence, each of the latter three being influenced profoundly by the work of his predecessors.

The tale is based upon the writings of the principals and their contemporaries, but the color, realism, and cosmic point of view depend largely upon the author's rich personal experience in South America and the familiarity he has gained with the "background" literature covering all the centuries since the discovery of the New World. The book is well documented, and four short chapters at the end cite the bibliographic references in a form that will prove useful even beyond its avowed purpose.

Certain errors of detail indicate perhaps that the work was completed with undue haste after Dr. von Hagen had entered the Army. The westernmost projecton of South America, for example, is not in Ecuador. Sirius is never a "red" star. Atahualpa, the Inca, *was* baptized before being garroted; his alternative was to be burned. Mount Duida is not granite (although Spruce so reported);

Continued on page 235

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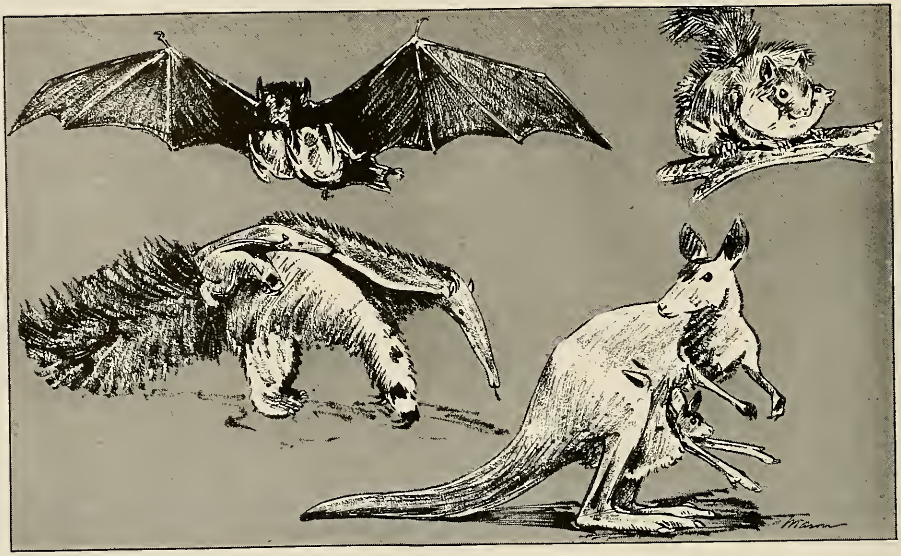
ANIMAL BABY CARRIAGES



By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

IN contrast to many of the lower classes of animals which lay their eggs in a suitable place and thereafter leave their offspring to their own devices, mammal mothers all take care of their young. Many species not only feed their babies, they carry them around wherever they go and thus are able to protect them from enemies.

The pouch of the kangaroo and other marsupials is an ideal arrangement for carrying youngsters. The mother has a capacious pocket of skin on the underside of the body. Inside are the mammary glands, to provide nourishment. The baby is born at a very undeveloped stage, much like an embryo of higher mammals. The mother licks a path to the pouch, and hand-over-hand the inch-long, pink, grublike creature makes its way through the moist fur. Inside the pouch, the newborn marsupial attaches to a teat, and the mother pumps milk into it by means of special muscles, for the young kangaroo is unable to suck. Here in the pouch it remains until it grows into a miniature kangaroo, the size of a rat; then it comes out to play around and feed on grass. At the first sign of danger, or when it gets tired, the young kangaroo dives headfirst into the mother's pouch, then turns a sort of somersault, bringing its head out between its hind legs.

Mothers of other orders of mammals have no such convenient pocket for their babies. The anteaters of South and Central America carry their offspring pickaback, just as a human parent may play with a child, but the closely related, upside-down sloths let their babies ride right-side-up on their chests. Babies of lemurs and of most South American monkeys ride on the backs of their parents until almost fully grown, while youngsters of the Old World monkeys and apes hang on the underside of their mother. We wonder why they do not fall off when the mothers jump from branch to branch, or why they do not interfere with the mother's locomotion. Often the mother sits up on a branch, holding her baby as a human mother might.

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Animals that make dens or nests for their young, usually leave them at home while they hunt food, but they may have to change dens through fear of an enemy. A mother of the cat or dog tribe picks up her young, one at a time, by the scruff of the neck and carries them dangling from her mouth. Squirrels pick up their babies by the underside, the young one curling around the mother's head.

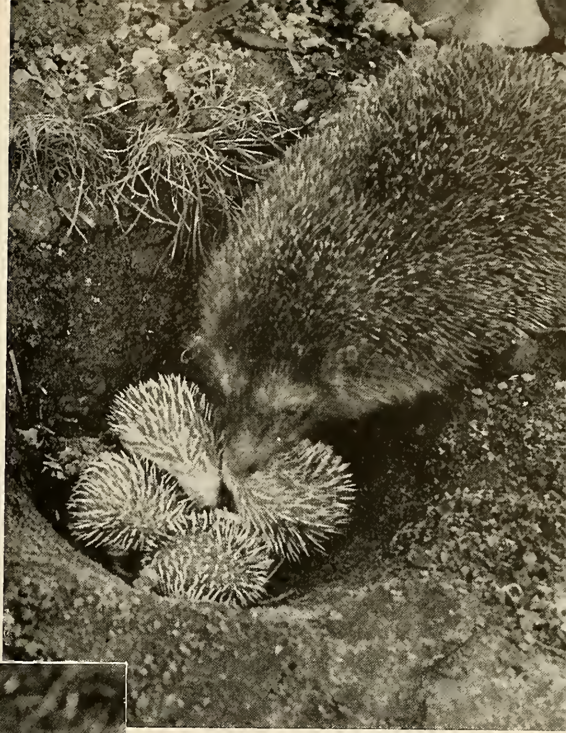
One day on the side of a canyon in the Rockies we saw a nest hanging from the bough of a fir tree about five feet above the ground. There was a hole in one side, and a lady reached in to see what might be there. She was surprised when out over her hand and up the tree flashed a mother pack rat with two half-grown youngsters dangling behind. Young pack rats have hooklike, diverging incisor teeth that lock around the mammae.

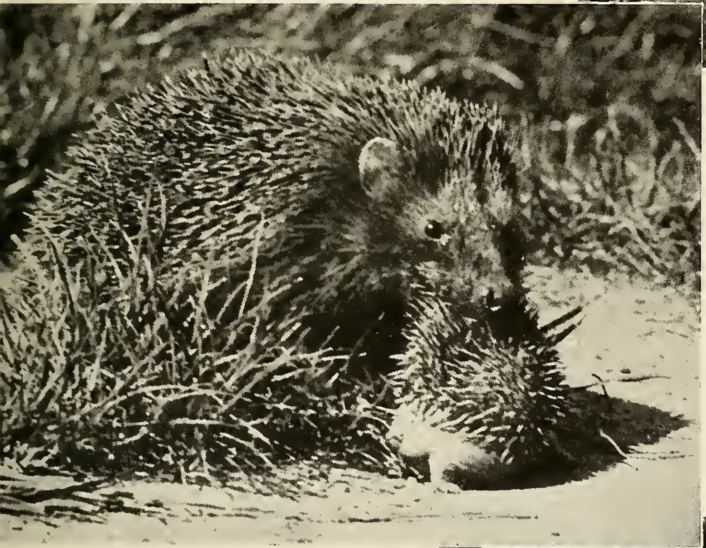
Some kinds of bats carry their young about with them until they are almost ready to fly. Our red bat usually has two babies, which hang on to their mother with tiny thumb-and-toe-claws, and hooklike milk teeth. How they manage to remain attached during the erratic flight of the mother is puzzling, but so is the way the mother bat can fly with such a burden.

Mother Hedgehog and her Young

Hedgehogs are about ten inches in length when fully grown, with an inch-long tail. They are insectivores, distantly related to shrews and moles and not in the least like our porcupine, except for their spiny protective armor. They are nocturnal in habits, and feed largely on snails, worms, insects, mice, snakes, and small birds. Two litters of young, usually four in number, are born each year, one in the spring and the other about September. The babies are at first nearly naked, and when the spines appear on their backs they are soft, only hardening after about three weeks

Steiner Photos, from Leon





◂ The mother picks her babies up by the skin of the back, spines or not, as seen in this picture

▸ Here the young are almost large enough to fend for themselves, but they are still following their mother

The Domestication

By CLARK WISSLER

Curator Emeritus of Anthropology, American Museum of Natural History

WHEN you begin to think about the domestication of animals you are moved to make certain assumptions. You take for granted that there was a time when no one anywhere thought of taming an animal; then you may try to guess what animal was the first to be tamed and compose an imaginary set of plausible incidents leading to the acquisition of a fireside pet.

You have a right to speculate in this way and may expect that most of your guesses have been made time and again by hundreds of other people. If you experiment by asking friends their guesses as to the first animal domesticated, you will find that many of them will choose the dog. They will be prepared to defend the proposition by such statements as: "Most savage tribes have dogs," "It seems most natural that man and dog should take to each other," etc.

In modern civilized life the term animal husbandry is used to designate the rearing of animals of economic importance. This, of course, includes those that produce meat, milk, hides, wool, and hair, or furnish power for traction and transportation, such as, cattle, horses, asses, hogs, camels, sheep, goats, reindeer, poultry, etc. While it is correct to say that the first domestications of such animals were prehistoric and therefore shrouded in mystery, we should recognize that paleontology and archaeology do furnish some pertinent data for a few sound conclusions as to when and where the rearing of the most important animals was first achieved. Since we assume there was a time when the ancestors of modern man were in most respects wild men living among the wild ancestors of our domestic animals, it may help us to look backward to see what wild beasts were their contemporaries.

Paleontologists and archaeologists seem to agree that the earliest human bones known are those of *Homo mojakertensis*, found in Southeast Asia in fossil beds of Early Pleistocene time, the geologic period that began approximately a million years ago. However, the human bones to which we have referred are from fossil beds in late Early Pleistocene time. Among the wild animal bones in these same beds were earlier representatives of the animals we know today as elephants, horses, cattle, deer (two kinds), and camels. Pigs appear with man in middle Pleistocene time; sheep, wolves, foxes, etc., appear with other human bones in the late Pleistocene. Thus it is clear that species of the great families from which the world's livestock was derived by domestication were characteristic of Pleistocene time. And the first men we know anything about (six or seven extinct species of man) were a part of the wildlife of that era and preyed upon these wild animals, at least as soon as they learned to use fire and make crude tools. There is every reason to assume that increasing human population spurred early man to hunt in teams and to stalk the larger animals, driving them into bogs, over cliffs, and into pits dug for the purpose. Fire was obviously one of the most powerful weapons in this cooperative trapping and killing of game. Positive evidence of fire appears with man of the Middle Pleistocene in Eastern Asia and persists through Late Pleistocene to the present. Its use may not be as old as stone tools and speech but is relatively very ancient.

Another assumption upon which there is general agreement is that the invention of agriculture and animal husbandry came at a relatively late date and must be credited to *Homo sapiens,* the human species to which we belong. Archaeologists have observed no signs suggesting the domestication of animals or plants by any earlier but now extinct species.

If the reader is interested in possible biological evolutionary changes in man's structure and function, he should note this coincidental advent of a new human species and such a revolutionary way of living as the domestication of plants and animals. There is a puzzle here. The use of speech, fire, clothing, dancing, and many other fundamental inventions are credited to extinct species of man. Was it necessary, then, that the world wait for a new species to evolve before another series of epoch-making inventions were achieved, few, if any, of which appear more difficult than those preceding? If there are such things as true paradoxes, this may be one of them.

Order of Domestication

The usual assumption is that the dog was the first to be domesticated. One of the supporting arguments is the almost world-wide distribution of the dog. There is a widely accepted theory that the larger the geographical distribution the greater the age, though no critically minded person regards such evidence as infallible. However, the dog is the only domestic animal common both to the Old and the New World in ancient times. Even so, the dog appears late in the archaeological record, about on a level with agriculture in the Old World. In the New World his remains appear relatively late; they are conspicuously lacking in the sites associated with extinct animals, as at Folsom, Clovis, and the Strait of Magellan.

Turning back to the Old World, the pig seems to rank next in extent of distribution, reaching the far western and eastern margins of the land mass, and extending into the Pacific Island area. A number of species with local distributions seem to have been domesticated, whereas with most domesticated animals the tendency was to exploit a single species, which was then spread abroad by man himself, suggesting a single source of origin. In fact, whenever more than one species of ancestor is suspected, the scientist feels impelled to assume independent centers of domestication.

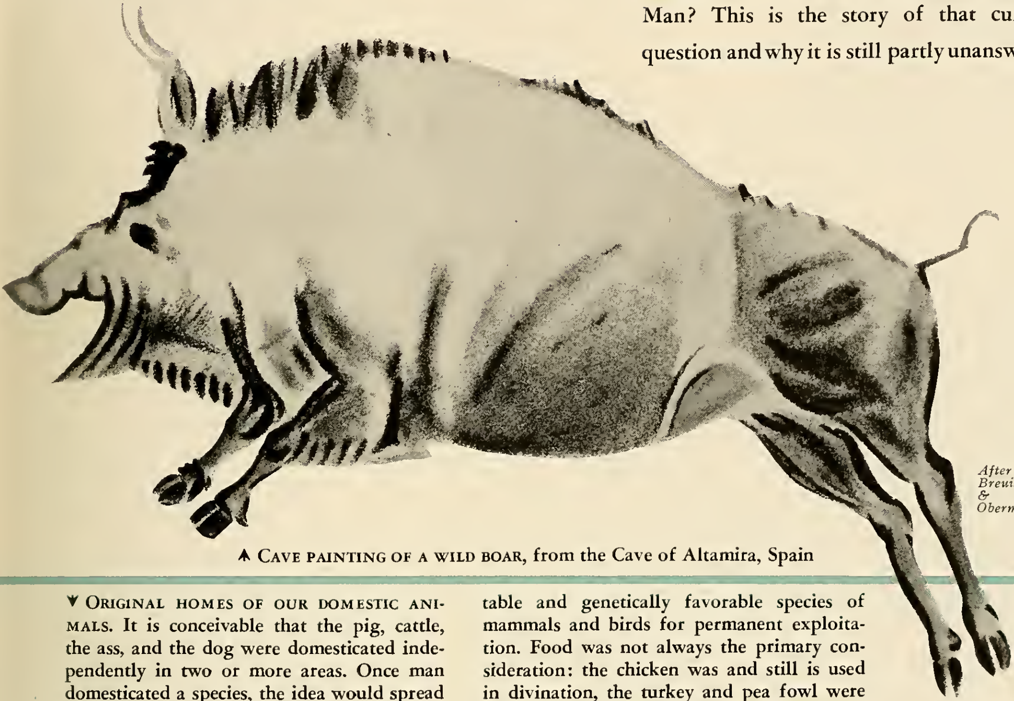
Somewhat smaller distributions belong to cattle. And we have some archaeological evidence suggesting still later dates for the domestication of most of the other domestic animals, such as reindeer, horse, ass, sheep, goat, camel, elephant, poultry, etc. In this way the following time sequences have been proposed: (1) among the first, the dog and the pig, (2) next in order, cattle and reindeer, (3) sheep before goats, (4) the ass before the horse, and (5) the horse before the camel and the elephant.

In much the same way the ranges of the wild species suggest the places of first domestication, as shown in the map on page 201.

For the dog, two separate derivations have been proposed,—jackal and wolf. For horned cattle, three localities are offered, and possibly as many subspecies, — the steppes, the valley of the Euphrates, and forested parklands in Europe. In the case of

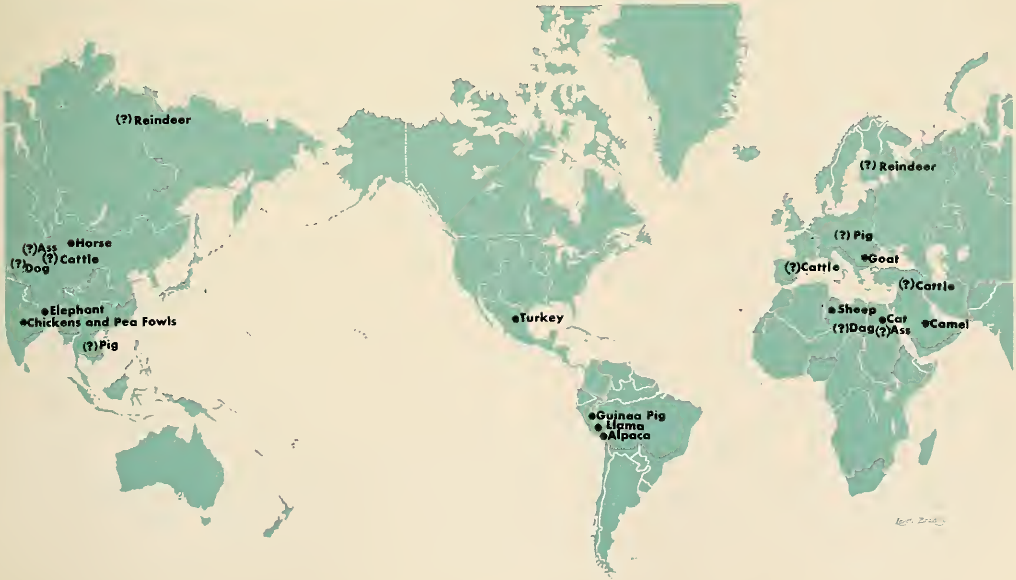
f Animals

Was it Man's need for animals that created what was to become one of his greatest sources of pleasure, comfort, and economic support—or was it the animals' need for Man? This is the story of that curious question and why it is still partly unanswered


After Breuil & Obermaier

▲ CAVE PAINTING OF A WILD BOAR, from the Cave of Altamira, Spain

▼ ORIGINAL HOMES OF OUR DOMESTIC ANIMALS. It is conceivable that the pig, cattle, the ass, and the dog were domesticated independently in two or more areas. Once man domesticated a species, the idea would spread from tribe to tribe, suggesting experiments with all wild animals. It is probable that by trial and error, man selected the most tractable and genetically favorable species of mammals and birds for permanent exploitation. Food was not always the primary consideration: the chicken was and still is used in divination, the turkey and pea fowl were bred for their feathers, the camel, elephant, and horse for transportation, etc.


(?) Reindeer
(?)Ass
•Horse
(?)Cattle
(?)Dog
•Elephant
•Chickens and Pea Fowls
(?)Pig
•Turkey
•Guinea Pig
•Llama
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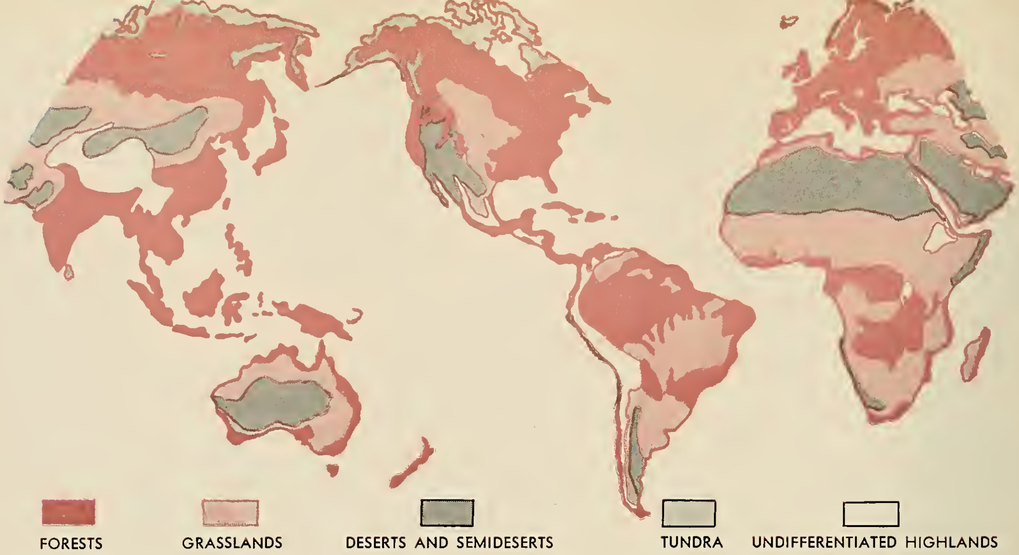


▲ Grazing areas of the world. Nomadic peoples frequented the margins between deserts and grasslands, where with expert handling, cattle, horses, sheep, and goats would fare well. Domestication only required substitution of herding for any habitual seasonal migration behavior the wild stock may have acquired. The pig did not thrive well in either desert or grasslands: forests, moist and even swampy, were his natural habitat. His range, in the Pleistocene, was from India to extreme western Europe, including the Fayum in north Africa

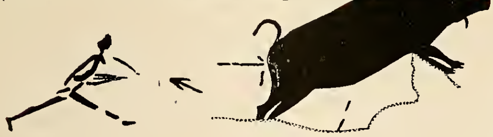
▼ Driving domesticated pigs to market: a scene among the Bontoc Igorots in the Philippine Islands. The distribution of the several wild species of swine was apparently almost world-wide, but domestication seems to have originated in Egypt and far-eastern Asia

the pig, several localities ranging from Spain to Burma are suggested. Yet these are still little more than hypotheses. In the New World the dog seems to have been introduced from Asia.

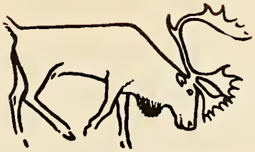
Habitual Associations between Man and Wild Animals

When people argue that it was natural for dogs and men to tolerate each other, they have in mind the differences that are obvious in the inborn behavior of the various other species of animals. For example, one reason for favoring the pig as one of the first wild animals to be tolerated in a camp or village is that in many parts of the primitive Old World, especially in New Guinea, the female pig with her litter moves freely about the village to feed upon offal and scraps of food discarded by the various households. The mother pig learns to look upon individual families as the source of regular "hand outs," and in turn her piglets are fondled by the children of the household and not infrequently allowed to feed from the breasts of the women. On the other hand, the adult boar is not tolerated in the village but banished to the surrounding bush, where he is hunted like other wild game. However, since the females are not kept in pens but run about freely, the wild boars have no difficulty in meeting them at night or in the edge of the bush by day. In the village the pigs not only destroy accumulating garbage and filth but prey upon crawling and creeping creatures whose presence would be more than a mere nuisance. The natives not only recognize these services but, since the

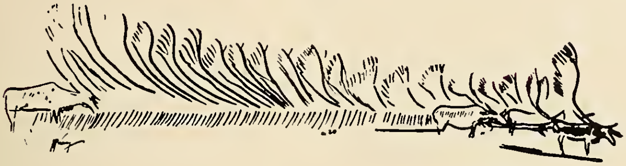
▼ CAVE MAN AND THE WILD BOAR. (*From Obermaier's* Fossil Man in Spain)



➤ ENGRAVING OF A WILD REINDEER: European cave art. This is the most famous sketch of its kind



After Keith Henderson, in Primitive Man, *E. P. Dutton & Co.*



After Capitan and Breuil

◄ A CAVE ARTIST'S IMPRESSION of a herd of wild reindeer, engraved upon an eagle's bone, Magdalenian time, France

➤ THE REINDEER is not a strong animal but can carry a medium-size person or a light pack load. Lamoot Woman and daughter, Siberia

A.M.N.H. photo

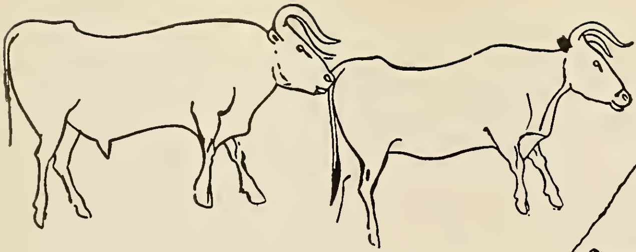
pig bears two litters a year, look upon the animal as a steady food supply. In the forested regions of western Europe hogs were herded while feeding on nuts and roots and in time were propagated for food and hides. Read the opening scene in Scott's *Ivanhoe* for an understanding of the economic importance of pig culture in Middle Age Europe. Even then boars seem to have run wild and been pursued by hunters, the head of the wild boar being regarded as the prize of the epicure.

Reverting to the dog, it is usually assumed that its wild ancestors, attracted by discarded food and the warmth of the campfire, gradually wormed their way into human society and rewarded those who tolerated them by detecting the approach of enemies and volunteering assistance in the hunt. Thus the association between dog and man could grow up naturally, the only surprise being that there is no trustworthy evidence for such mutual tolerance before the appearance of agriculture, about 10,000 years ago.

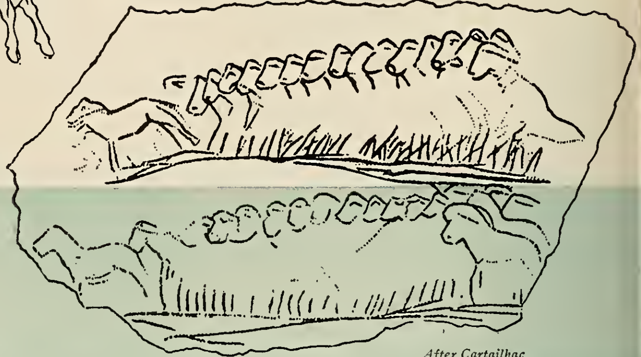
Wild cattle and reindeer were grazing animals, inclined to form relatively large herds and to seek tundra, grasslands, or park lands (open spaces in forested areas). Both are adapted to cool climates or seasonable habitats, in which they learn to migrate back and forth from north to south. The reindeer range farther north, even to the margins of glaciated areas, while cattle prefer the milder climates of the temperate zones where wet and dry seasons alternate. Reindeer roamed over middle Europe in glacial times, and since they still survive in wild herds in Arctic and sub-Arctic latitudes, we may assume that they shifted their range with the glacial cycles, northward in interglacial periods and southward in periods of advancing glaciers. No doubt the several species of man were troubled by these same cycles of cold weather. Four periods of alternating glaciation are accepted as having occurred during Pleistocene time. Post-Pleistocene time, in which we now find ourselves, may well be the fourth interglacial period, to be

A.M.N.H. photo

▼ CAMP OF NOMADIC KORYAKS, Siberia, with their domesticated herd of reindeer. The wall-tent in the center belongs to an American Museum of Natural History Expedition. The large tents are covered with reindeer skins, which with their poles and the baggage of their owners are transported by sleds drawn by trained reindeer

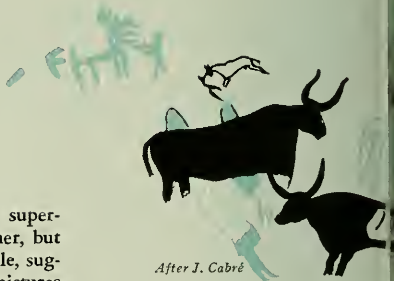


◀ **Wild cattle** from Grotte de la Mairie, France. Horned cattle were widely distributed throughout Asia and Europe before the Age of Man. Good pictures of them appear in *Cave Art* after Capitan and Breuil



➤ **A cave artist tries** his hand in sketching herds of galloping wild horses. A slab of stone from Cave of Chaffaud, France

After Cartailhac



➤ **Primitive artists** frequently superimposed one picture upon another, but here women are shown with cattle, suggesting herding. However, the pictures are believed to be early neolithic and are therefore contemporary with early agriculture. Cave of Cogul, Spain

After J. Cabré

followed in the distant future by a fifth glaciation. Consistently enough, the earliest known man (*Homo modjokertensis*) appears in Java during the first interglacial period when the climate there was probably tropical, as at present. Middle Pleistocene time seems to begin with the second glaciation, and this is when man in China (*Homo sinanthropus*) began to use fire, probably with good reason.

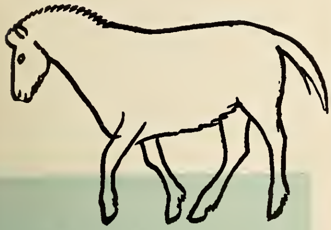
Whether reindeer were the first large grazing animals to be domesticated is not very important, and there is some reason to suppose that the date was much later than that for cattle. It is probable that cattle were among the first, but sheep may have preceded them, since at the famous archaeological site of Anau, Turkestan, bones of sheep were found beneath those of cattle. Some weight should be given to priority for sheep on the grounds that they are probably easier to control than either cattle or reindeer. But sheep were probably domesticated in one locality and cattle in another, so that it is difficult to prove which should be given priority in world chronology. Goats, also, may have preceded cattle, but the archaeological record seems to reveal no goat bones earlier than those of sheep or cattle.

Cattle, reindeer, and goats were milked, so we have no basis for deciding whether flesh or milk was the primary consideration. Asses and horses were milked too, but since it is assumed they were domesticated later than cattle, the use of their milk could have been suggested by cattle herders. In any case the first domesticated animals to be milked would suggest experiments with other domesticated species.

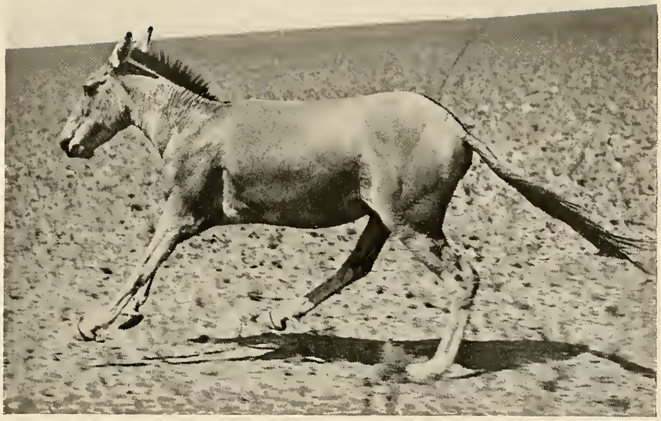
The chief interest in reindeer is that both wild and tame reindeer survive and that not so long ago some Siberian tribes treated wild reindeer as game, killing them in the chase. At the same time, other tribes, recognizing that even wild reindeer moved in herds, shifted their camps with the migrating deer, taking care not to stampede the herd. Still others exercised some control by gently driving the herd to new pastures, protecting it somewhat against wolves and even against other hunters, thus naively conceiving ownership of a particular herd. At the other extreme is the complete control of the herd and the use of some individual animals for transportation, by saddle and sled, for milking, etc. It is not difficult to see here all the logically conceivable steps in the gradual domestication of the reindeer. The story for the domestication of cattle, horses, and other animals could have followed the same pattern.

Man's ability to provide protection for animals and supply food in times of scarcity puts the herded animals in his power. For example, the winter-feeding of elk in our National Parks tends to hold them to the feeding ground; the herd will stay around the spot and starve rather than migrate to fresh pastures. When mounted herders drive them to new grounds where feed is abundant, the homing instinct of these erstwhile

▼ Drawing of a wild horse from the walls of Font de Gaume, France, considered one of the finest examples of cave art



After Keith Henderson, in Prehistoric Man, *E. P. Dutton & Co.*

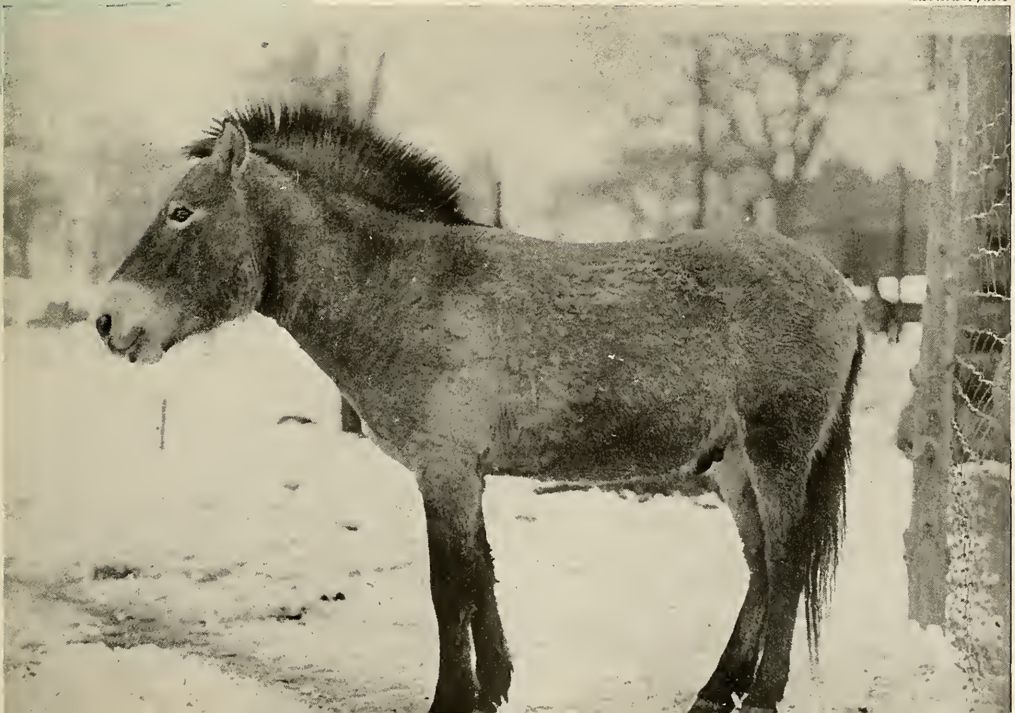


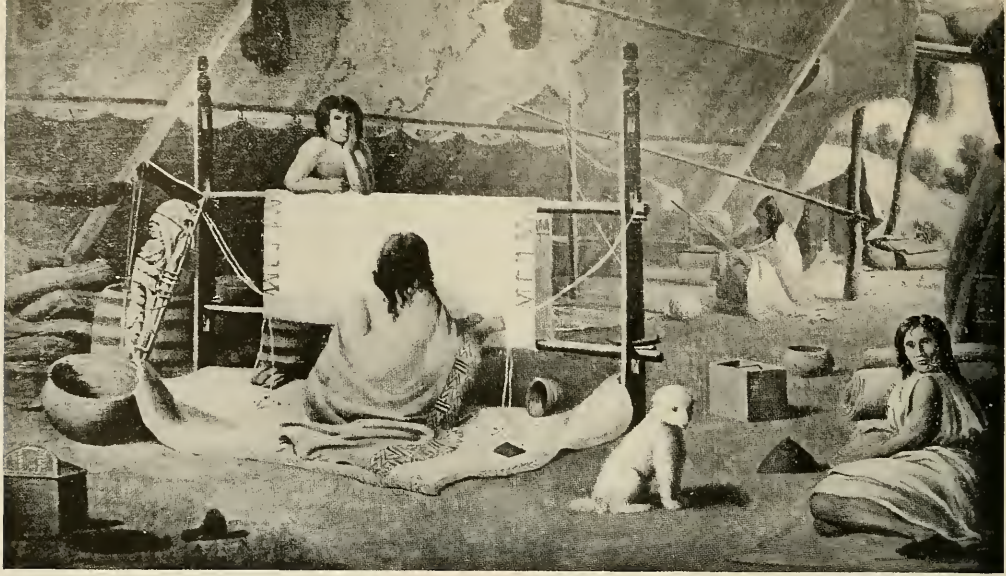
A.M.N.H. photo

▲ The wild ass of the Gobi Desert. The ancestors of the long-eared, heavy-muzzled, droll-visaged donkey ran wild in North Africa, a different species from the more horselike creature of the Gobi. Certain low-relief sculpture of the Sumerians show asses of the Gobi type harnessed to chariots, apparently valued for their speed, whereas the Egyptian artists depict the heavily-laden donkey, plodding beside his foot-going master

▼ The Przewalsky horse of Asia, assumed to be a descendant of the wild horse of Stone Age France, depicted above

A.M.N.H. photo





From a painting by Paul Kane in 1846

▲ **A British Columbia Indian** weaving a blanket of yarn spun from the wool of the white dog shown at her right. These dogs, bred and sheared for their wool, became extinct soon after white contact

wild elk brings them back to the feeding place, where they will die of hunger if not fed, failing to remember the places where pasturage was plentiful. It would seem that in providing winter food for a single season wild elk were essentially domesticated and rendered incapable of survival. If they had been herded on the new range for the season and then returned to their former feeding ground and this process continued year after year, we should regard them as domesticated. After all, there is nothing very mysterious here: we mention it to clarify our understanding of what may have been a natural process.

Tribes specializing in the control of flocks and herds but making no attempt at agriculture, are usually characterized as nomads or pastoral peoples. Some years ago there was a favorite theory that, in the evolution of society, hunters passed first from hunting to herding and later took up farming. This can be made plausible, but it is now realized that the environment determined where herding and agriculture could best be developed and that the first great civilizations were brought about by a combination of stock raising and agriculture. In an earlier article* we suggested that the most favorable locations for such an integration were the narrow valleys of rivers coursing through deserts, as the Nile, Euphrates, and Indus, where, during the rainy season, herds could be pastured upon the adjoining desert lands and brought back to the marshes and deltas for winter feeding.

As in the case of plants, man soon learned that selective breeding could rapidly change the body build and the behavior of his live stock, if mating were rigidly controlled. Sheep wool is so different from that of surviving wild sheep that its origin is considered to be due to man's care in breeding. In western Canada the Indians even bred a strain of dog with white wooly hair, excellent for spinning. They also spun the hair of the local wild goat but without domesticating him. The hair of surviving wild sheep in North America is too smooth to be practical. In Peru, the hair of llama, alpaca, and vicuña was used to spin yarns, usually for the warp in cotton fabrics.

In conclusion, it is by no means clear whether the larger share of credit for the domestication of animals can be justly claimed by man. The behavior patterns of the animals to be domesticated may have been the first cause, and the long delay on the part of man may have been due to his own predatory habits, which automatically classed him with the larger carnivorous animals. That man made little effort to domesticate tigers and lions is clearly logical; and in a region where people lived by hunting it is far from obvious that herds of relatively defenseless animals should seek food and protection around the camp.

Yet there are suggestions that when hunters came to be in part farmers and their food crops lured grazing and root-eating animals to the villages, the villagers would be prompted to adopt one of two expedients in defense of their own food supply—driving the herd away or leading it to pastures farther afield and holding them there. Thus automatically and without thought on the part of anyone, a habitual relationship between the herd and the village would evolve and perpetuate itself. Later, some speculative sage would make an original contribution to social belief by remarking that the herd was now community property. Note that the relationship between the herd and the village first came to be a reality; only later was *thought* applied to it, giving expression to the relationship in words and finally causing it to be taken for granted.

The part that the much vaunted "human intelligence" played in the achievement seems to fade into obscurity. The herders may have been as blind to the initial steps in domestication as were the herded. Why, then, should we be astonished when told that some ant colonies keep herds of "milk-giving insects?" Probably because we consider man very intelligent but look upon the ants as devoid of that quality.

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* "Wheat and Civilization," by Clark Wissler, Natural History Magazine, Nov. 1943, page 172.

HAWKWAYS

By EDWIN WAY TEALE

A lookout on the Kittatinny Ridge once provided good hawk-hunting during the migrating season. Hawks are still hunted from the Hawk Mountain Sanctuary—but with fieldglasses and cameras instead of guns

SCUDDING low, soaring high, riding the wind on half-furled wings, they came down the long valley, over red and yellow miles of autumn foliage. We could see them from afar through our glasses. Singly, in twos and threes, a dozen at a time, the hawks swept into view. They drew abreast of our cliff. They slid past on almost motionless wings. They grew small in the distance. In this same way, and past this same cliff, autumn hawks for centuries have been riding the invisible tide of the updrafts. Each fall, when the trees of the mountainsides, viewed from afar, seem turned to little puffs of colored smoke, the birds soar down this ancient hawkway to the South.

Early that morning, we had driven out of a valley in the mountains of eastern Pennsylvania, jolting over a narrow, rocky road that wound steeply upward. Leaving the car, we climbed through woods and past great lichen-blotched boulders and into a V-shaped grotto, formed like an amphitheatre and walled in with uptilting layers of Tuscorora sandstone. At its far end, a kind of stairway cut in the solid stone, carried us upward to the edge of a great promontory. All along the brink of this sheer, thousand-foot cliff, dead trees formed a vast Aeolian harp. Their dry twigs and branches hummed, with varying notes, in the rising breeze.

Clambering over great slabs of jumbled, whitish rock, mottled with leathery splotches of lichen, we reached a wild cherry tree that flared away from the precipice and brought to mind the image of a high, green candleflame blown by the wind. Beyond, we came out upon the bare tip of the promontory. This area of tumbled slabs opened on a wide and colorful prospect. The Kittatinny, the "Endless Ridge" of the Indians, stretched away before us.

Below this giant's lookout, farms and roads and woods spread up the valley to the farthest limits of our vision. They streamed away in the other direction until they were lost in the distance. A toy train, under a toy cloud of smoke, hugged the bank of the river that curved outward from the base of the cliff and wandered across the floor of the valley. Midget cows and horses grazed in tiny pastures or clustered together in Lilliputian barnyards. And all across this wide expanse of farming land, on this October morning, cloud-shadows and patches of sunshine followed each other, dappling the floor of the valley. The harvest was over and hardly a man could be seen working in the fields. The time of planting and reaping was past. The days of advancing autumn had come. And they had brought, as they had brought from time immemorial, the soaring of hawks overhead.

To take advantage of upcurrents along the western face of the long ridge leading to the South, hawks from all over New England and from above the St. Lawrence in Canada, each year, funnel into the northern end of the valley. In reaching this groove in the Earth's surface, many of them had soared along

▼ HAWK MOUNTAIN SANCTUARY. When purchased in 1934 by the Emergency Conservation Committee, of New York City, it ceased to be a hunter's playground and became the world's first hawk sanctuary

HAWK MOUNTAIN SANCTUARY

▲ BEYOND these giant lichen-spotted boulders, the sheer thousand-foot precipice falls to the valley below. The wind-lashed wild-cherry tree offers mute testimony to the prevailing force of the updrafts

the ridges of the Connecticut valley, past Mt. Tom in western Massachusetts, across the Hudson River near the Bear Mountain Bridge, over the New Jersey countryside and across into Pennsylvania. By choosing terrain with the best updrafts, they reduced their expenditure of energy to a minimum. Once the long valley of the Kittatinny Ridge was attained, they sailed almost without an effort —just as their ancestors had done for hundreds of years—mile after mile on their long journey to a winter home.

During the early years of the present century, and even into the Nineteen-Thirties, many of these birds got no farther than the cliff on which we stood. Taking advantage of the fact that the migrating hawks frequently were forced close to this observation point in hugging the ridge to keep in the updrafts, local gunners and big-city "sports" blasted away, riddling the slow-moving birds as they soared, almost helplessly, within range of their guns.

After such a Roman holiday of "sport," as much as a wagonload of birds, dead, maimed and dying, would often litter the foot of the cliff. The stench of their decomposition filled the air all during the height of the migration period. Shotgun shells, tossed aside on the rocks of the observation point, accumulated in such quantities that it was worth the while of a junkman to come to this remote spot and salvage the brass they contained. The bill for this annual festival of slaughter was paid by people all over the Northeastern states. Rodents, which hawks that had been killed at this vantage point would have consumed, multiplied in consequence of the activity of the gunners. Some of the latter undoubtedly felt justified in the slaughter through the mistaken belief that "the only good hawk is a dead hawk." But most of the gunners considered the pleasure of exercising their skill and the joy of letting blood justification enough.

This state of affairs continued until the Emergency Conservation Committee, in New York City, raised funds, purchased this ridge-top observation point and turned it into the world's first sanctuary for hawks. That was in 1934. Since then, the now world-famous Hawk Mountain Sanctuary, north of Hamburg and near the village of Drehersville, Pa., has attracted thousands of visitors. Special excursion trains for bird-watchers have been run to the area during the migration season. Maurice Broun, ornithologist in charge, recorded, during eight autumn seasons, the passage of more than 125,000 hawks.

Different species are frequently more abundant at special times during the migrating season and often at special times during the day. Bald eagles, for example, are seen going south most often in the early days of September. Broad-winged hawks appear in largest numbers between the tenth and the twenty-sixth of that month. During a single September day, Broun once saw 4,078 broad-

▼ ANCIENT HAWKWAY. Over these steep and rocky cliffs, hawks for centuries have soared southward on the invisible tide of mountain updrafts

▲ THE KITTATINNY, "Endless Ridge" of the Indians. Within but a few yards of this rock-strewn promontory skim thousands of hawks each year, while crowds of visitors line its edge to watch

winged hawks sail past his promontory lookout.

The prevalence of the different species varies widely from year to year. In 1938, the number of broad-winged hawks passing the observation point reached the total of 10,761; in 1934, the total was only 2,026. In 1939, the number of sharp-shinned hawks was 8,528; in 1940, it dropped to 2,407. In 1935, 239 goshawks passed Broun's lookout; in 1938, the number was only nine. Weather conditions during the migration season undoubtedly have much to do with the fluctuations. Only on days when the wind is from a westerly direction, producing strong updrafts along the face of the ridge, do you get a large flight of hawks down the valley.

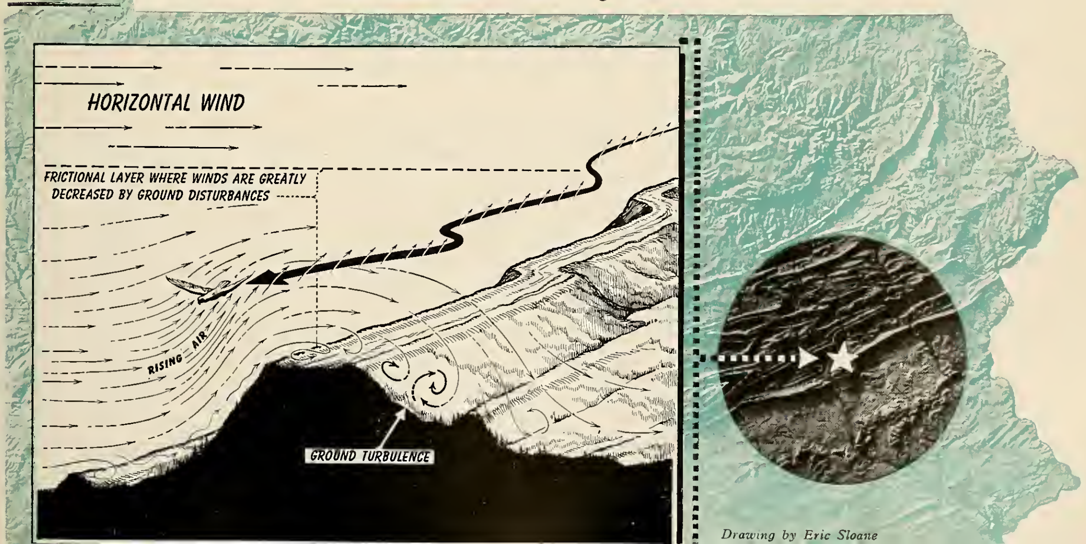
On the October morning when we swept the valley and the ridge-side to the north with our fieldglasses, it was sharp-shinned hawks that most often came into view. Usually, they were flying low, scudding over the trees, with the autumn colors of the woodland streaming to the rear beneath their wings. One of these hawks, coming up the lee-side of the ridge, met the westerly wind head-on, and it hung for a moment in the air almost directly above the slab on which I sat. Its upper-body, I saw as it slanted away, was blue-gray. This pronounced it an old bird. It also gave point to the common name for the sharp-shinned hawk: The Little Blue Darter. Younger birds that passed close to the edge of the cliff were more brownish in hue.

Nine-tenths of the sharp-shinned hawk's diet probably consists of small birds. I remember one adventure of the mind when, for a terrifying moment, I became the hunted, fleeing bird with one of these hawks in close pursuit.

I had been standing motionless in a small grove of tupelo trees watching some late-autumn white-throated sparrows feeding on the ground and darting among the bushes. Suddenly every bird in the grove became silent and watchful. I had seen nothing, heard nothing. It was minutes before I discovered a sharp-shinned hawk perching motionless in the top of a dead tree an eighth of a mile away. It had slipped silently into position. Yet every small bird in the vicinity was aware of its menacing presence.

Fifteen minutes went by. The sparrows began to feed again, alert and uneasy. Then, without warning, the small birds seemed to explode in

▼ THE HAWKS and other birds follow Kittatinny Ridge in order to take advantage of its updrafts on their long migration flights. The natural currents of air, rising from the land to the west, enable them to soar long disances with little exertion


HORIZONTAL WIND
FRICTIONAL LAYER WHERE WINDS ARE GREATLY DECREASED BY GROUND DISTURBANCES
RISING AIR
GROUND TURBULENCE

Drawing by Eric Sloane

▲ BEYOND THE RIDGE, the rolling valley and its miniatures of civilization stretch far away. Pleasure-seeking gunners, shooting from the edge, used to send many of the close-flying birds to their death a thousand feet below

all directions around me. The hawk, like the shadow of a bullet, swift and silent, streaked into the thicket. Already, it was in close pursuit of a wildly fleeing white-throat. That pursuit would have ended tragically for the sparrow had I not let out a sudden shout and waved my arms aloft. The hawk veered, shot almost straight up, disappeared. The small bird, whose escape I had mentally shared, dashed into the protection of a bush.

In the open sky, the way of a bird with a hawk is often a mysterious thing. Above the waving cattails of a piece of Long Island lowland, I once saw swallows, two score or more, come together from all parts of the swampy area and begin whirling about in a large, loosely-knit flock. A sharp-shinned hawk had come scudding low across the marsh. The swallows whirled around and around, rising as they circled. The hawk, 30 feet below them, circled too—climbing as it turned, giving quick flaps of its wings between short glides.

The pursued swallows rose continually higher, with the hawk climbing behind them. Spiraling upward in this fashion, they moved away to the east, over the trees beyond the swamp, above the streets and houses of a neighboring town, higher and higher, until the swallows seemed no larger than bumblebees and the pursuing hawk the size of a small butterfly. And thus they disappeared. How the duel of wings ended, I did not see. But, judging from other observations of small birds that remained in a compact, whirling flock in the presence of hawks, I am sure the swallows outwitted their foe.

On another occasion, I watched starlings performing in a similar manner, but with a curious exception. Half a hundred of these dark birds were circling in a close-knit mass 100 feet or so above the ground. A Cooper's hawk was swinging in slow, soaring circles near-by and at the same altitude. Minute after minute, the starlings and the hawk kept turning like gears of different size moving in synchronization. When the hawk moved closer, the whirling mass of starlings drew away. When the hawk circled off, the starlings, unlike the swallows, instead of putting further distance between themselves and their enemy, followed as though drawn along in its train.

But the smaller birds never for a moment failed to maintain their compact flock. No single bird made the mistake of separating itself from the safety of the mass. In the end, the hawk gave up, baffled. It straightened out and coasted away to the south. The starlings spun in their narrow circle a little longer. Then the whirling flock broke up so suddenly it seemed blasted apart. The individual birds darted down to the treetops and telephone wires below. The danger was over. Their flocking maneuver had brought them all safely through the crisis.

Unless small birds can flock together in the presence of a hawk, they are likely to be easy victims. A friend of mine once told me of a Cooper's hawk that made a regular morning visit to a barn on his place in the country. Swallows were in the habit of congregating on the eastern slope of the roof to get the full benefit of the early sunshine. Instead of flying toward them directly, the hawk would sail out of the woods, approach the barn from the rear, shoot up along the shadowed side of the roof and, bursting over the ridge, dive down the sunlit slope. This maneuver always took the swallows by surprise. They had no time to dart into the air and form a swirling flock. The Cooper's hawk was always able to pick off the swallow of its choice.

With the coming of noon at our observation point, there was a lull in the passage of the migrating hawks. But, on that October day, in many parts of the country, the hawks of other regions were following other skyways to the South. Some of these aerial trails are ill-defined and little-known. In the East, the most famous hawkway—outside of the one skirting the Kittatinny Ridge — is the route that follows the Atlantic coastline down to that southward-pointing thumb of land, Cape May, N. J. It was at Cape May that Alexander Wilson carried on many of his pioneer studies in American ornithology. Beyond the cape stretches the water of Delaware Bay. Confronted by this barrier, birds of many species hesitate and congregate near the tip of Cape May. Here they provide one of the great bird-spectacles of the East. I have seen ten thousand and more tree swallows swirling like swarming gnats through the air above Cape May. Everything from golden-crowned kinglets to bob-whites pause in uncertainty before flying on over Delaware Bay.

In connection with the hawks that reach Cape May, ornithologists have noticed an interesting fact. Fully 90 per cent of them are young birds that have tried their wings for the first time during the previous summer. It is suggested that these inexperienced migrants have been carried off their course by prevailing westerly winds and so have missed their mark —the hawkway along the Kittatinny Ridge—and have had to follow the coastline south. The older birds, such as we saw passing our lookout point, are better navigators. They have made sufficient allowance for wind drift and so have reached their goal, the mouth of the long valley.

As the afternoon advanced, the sharp-shinned voyagers decreased in numbers. The hour of the larger hawks had come. Broad-winged "mouse-hawks" now predominated. Soaring past us came the red-shouldered and red-tailed hawks. With their white rump-patches shining in the sun, lightly-loaded marsh hawks drifted by. Cooper's hawks skimmed below us. Once a pigeon hawk, following the more direct path of its flight, passed close to our rocky promontory. Among them all, it was the red-tails that now far outnumbered the others.

From time to time, our attention was drawn to some smaller migrant following the ridge on its flight southward. Song sparrows, robins, and even several tiny golden-crowned kinglets, fluttered down to rest in the branches of the ridgetop trees. After a short pause, they started on again. The hawks paid little attention to these fellow-travelers. They were taking advantage of the favoring wind; they were covering every mile possible on their journey. During the hours of early morning and evening they probably paused to hunt for food.

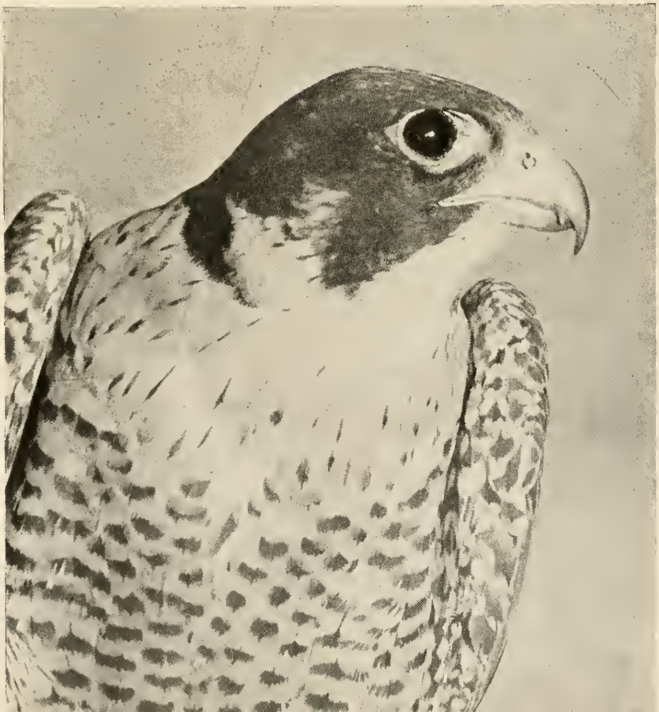
By two o'clock in the afternoon, we had counted a total of more than half a thousand hawks. And the aerial parade continued. The floor of the valley, a thousand feet below us, suggested the bed of some vast, transparent river on which the birds were floating. Other hawk-watchers kept arriving, from as far away as Philadelphia and New York City, to enjoy the show. With fieldglasses instead of shotguns, they were engaged in a thrilling outdoor sport. Someone set up a cry of excitement. Far out over the valley, he had caught sight of a large, dark bird soaring toward the South. It moved steadily, like an air liner, its wide wings seemingly unaffected by the minor gusts. All the fieldglasses on the observation point swung in its direction. It was the first golden eagle of the day.

Ten minutes later, in a long wedge, snow geese cut diagonally across the valley, high above our heads. For their heavily-laden and laboring wings, updrafts had little of the significance they had for the soaring hawks. Throughout the afternoon, crows trailed past in ragged, cawing flocks and in twos and threes. Well out over the valley, and alternating flapping their wings and soaring, the first ravens I had ever seen passed by. And, all the while, the hawks kept streaming past. Many of them flew by us hundreds of feet below our eyrie. They gave us an unfamiliar, a truly bird's-eye view of their passage.

Before we left, that October afternoon, we had seen well over 600 hawks. Our final sight, the most thrilling of the whole adventure, came as we were working our way back along the edge of the cliff, past the breeze sculptured wild-cherry and the dead trees, still producing their Aeolian harp music in the wind.

We were nearing the steep descent into the white-walled chasm when I turned to look back. At that moment, the six-and-a-half-foot wings of a golden eagle carried one of these rare and spectacular birds almost directly over the observation point. As it burst above the ridge, the eagle caught sight of the watchers on the jumbled slabs below it. In an instantaneous, spine-tingling stoop, it streaked downward along the sheer face of the cliff. No other bird has the speed of a golden eagle in its dive. The great bird, as it bolted downward, passed me like a black smudge against the landscape. That glorious plunge through space provided a mental picture that remained with us long after we had clambered down the rocky trail and reached the car below. It, of all the varied sights we had seen that day against the background of the autumn trees, stood out in later memory.

▼ **The Duck Hawk, rated as the fastest straightaway flier in the bird world and possessing a sharp tooth in its beak that enables it to cut its meat, is one of the more illustrious of the many varieties of hawks that stream past the Kittatinny Ridge**



TICKS—

Many are harmless, but dog owners, cattle raisers, and others are becoming increasingly aware of them as carriers of certain diseases. The simple preventive measures outlined in this article will prove valuable

By C. H. CURRAN
Associate Curator,
Department of Insects and Spiders,
American Museum of Natural History

TICKS, those little things that get on you when you walk in the fields or woods, are repulsive creatures, and few people can suppress a shudder when they find one on their person. These animals are encountered over most parts of the world, and in some places they are greatly feared by natives. The famed Doctor Livingstone found during his travels in Africa that the natives of the Congo region lived in deadly fear of certain kinds of ticks, claiming that their bites resulted in death. This was in 1857. Scores of years passed before it became known, in 1904, that certain kinds of ticks in that region were capable of carrying the often fatal relapsing fever. This is but one of a number of diseases carried by ticks and there was a time when ticks threatened to destroy the great cattle industry of Texas and adjacent states.

To understand why ticks can be such a menace and why they are, on the whole, increasing in America, it is necessary to know something about how they live and grow. There are many kinds of ticks and there is a great deal of variation in the way they live and develop. Some ticks, including those causing relapsing fever, lay only a few hundred eggs, but other kinds may lay as many as 40,000. Fortunately, those that are the greatest menace lay not more than 3000 or 4000, and of these only a small percentage can be expected to reach maturity. When an animal lays as many as 40,000 eggs, the chances are that only something like one in 15,000 will grow to maturity, since Nature provides a natural balance. No kind of animal is likely to show any permanent increase in numbers unless the normal conditions under which it lives have been changed. An increase in the number of animals upon which ticks feed will cause an increase.

Ticks have been increasing in the United States and Canada for two decades or more. However certain kinds have been reduced, owing to studies made by the Department of Agriculture and the application of specific control measures.

Most ticks require two or three different kinds of hosts upon which to feed, and these hosts are usually of different sizes. Notable exceptions to this rule are the brown dog tick, the winter tick, the fowl tick, and the Texas fever tick. These can all develop to maturity on a single animal, and two of them (the fever tick and the winter tick) never leave the host once they become attached to it. They are therefore known as one-host ticks. Ticks that become attached to animals only twice are known as two-host ticks. The brown dog tick drops off the host after feeding, so it is either a three- or four-host tick, even though it can develop to maturity on a single dog. Other ticks, such as the Rocky Mountain spotted fever tick and the Eastern dog tick, require animals of different sizes in order to reach maturity and are usually three- or four-host ticks.

When the young of these latter ticks hatch they are smaller than the head of a pin and are known as "seed ticks." Although ticks are not insects, they have at this stage three pairs of legs, like insects. Since the eggs are laid in masses of a thousand or more, the young seed ticks scatter as much as possible over the soil and among the blades of grass and leaves of low plants. They crawl up on the foliage and await the coming of some small animal, usually a mouse or ground squirrel. If such an animal comes within reach of their clutching legs, they grasp it and quickly work their way through the fur to the skin. Once there, they immediately begin to bore through the skin with their specially adapted mouth parts. It may take them two to six days to obtain a full meal of blood, but when fully satiated they withdraw their mouth parts with apparent deliberation and satisfaction, and seek a place of quiet where the meal can be digested.

When the tick drops from its host it is several times larger than when it began to feed, and assimilation by the digestive system may take from a week to two or three months. Steady growth occurs as the meal is digested, and the "stomach" decreases in size while other parts of the body increase. Since the skeleton of a tick is on the outside, there must be some relief, and to relieve the pressure, a new skeleton, quite expandable, is formed within the old one. When the original skeleton becomes exceedingly tight, it splits open and the emancipated tick crawls laboriously out. There is much pulling and tugging, because it is not easy to withdraw the new and larger legs and body from the confines of a skeleton that has a very definite limit of expansion.

There is one marked difference between the seed tick and the creature that emerges from it. The seed tick had only three pairs of legs. The "new" creature has four pairs (like spiders), and is flattened and leathery instead of being full-bodied and fairly soft. It also has aspirations. It will no longer be satisfied with a blood meal from a small animal. If it can find nothing else, it may feed upon one, but this is rare. Almost always it will die of starvation after a few weeks or months if it cannot find a larger animal, depending upon the kind of tick.

The tick has now become a nymph, and it is no longer satisfied with its former outlook on life. It now seeks low herbs or long grass. Here it sits upon the top of its world, waiting for a rabbit or coyote, or some other animal neither too big nor too small. If a suitable victim comes along within a month or two, the nymph attaches itself and gets another meal. If no suitable host should come along, the tick dies of starvation, and this is what happens to 99 ticks out of 100.

Ticks shed their skins and become mature after varying intervals, depending upon the kind of tick and the availability of food. Some kinds become mature in less than two months, after shedding their skins only twice. Others require two or three years and may shed their skins five or six times. Among those that seek larger hosts after each moult, it is only the mature ones that attack man and large animals. Few kinds of ticks complete their life cycle on a single host, but a large proportion of those that do are a menace to animal welfare.

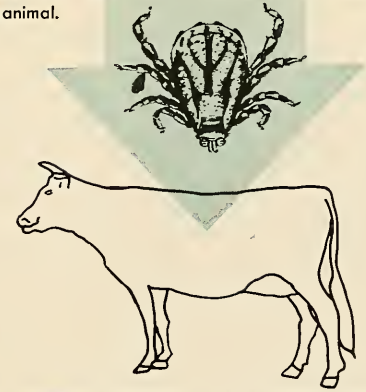
Back in the days when the West was in its infancy and great herds of cattle were raised on the lush grasslands that still supported innumerable bison, the cattle fever of Texas was well known. Large herds driven north from Texas in search of fresh

ıenace to animal life

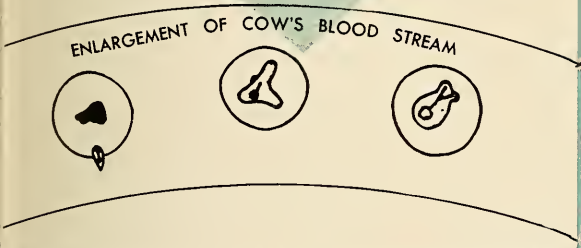
THE TICK AND THE ANIMAL

By no means all of the many kinds of ticks are carriers of disease. But one of them that is and has received much study in this country is the Texas cattle fever tick (*Boophilus annulatus*). Around the turn of the century, herds driven northward to new pastures were spreading the disease each year over a larger area of the middle Southern States when remedial measures were undertaken. Control of this tick depends upon a complete understanding of the tick's life cycle, outlined in these pictures.

The only way that cattle become infected with Texas cattle fever is by having a tick whose salivary glands carry the protozoan parasite attach itself to the animal.

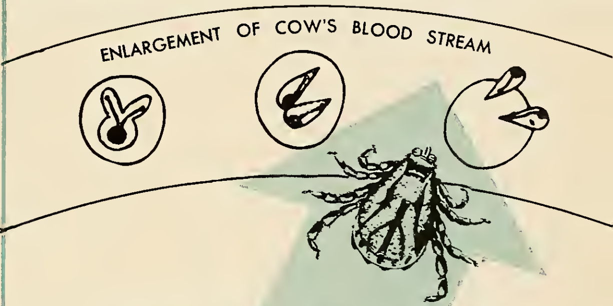


In the animal's blood, the parasite goes through a series of changes. The sick animal leaves the herd, stands with arched back and lowered head, and shows various systemic disturbances. Death rarely occurs, but the value of the animal is much reduced.


ENLARGEMENT OF COW'S BLOOD STREAM

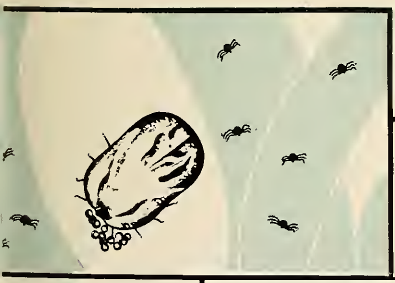
HANGES OF PROTOZOAN IN COW'S BLOOD STREAM

CHANGES OF PROTOZOAN IN COW'S BLOOD STREAM

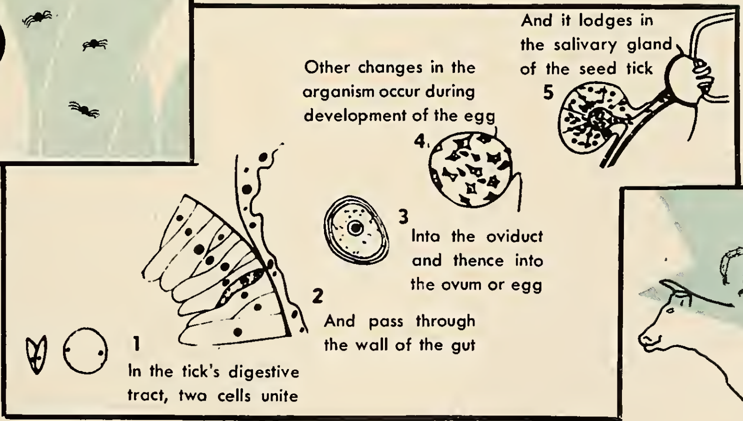

ENLARGEMENT OF COW'S BLOOD STREAM

The protozoan parasite continues its life cycle in the blood stream of the cow. Then, when an uninfected tick bites the afflicted animal, the tick acquires the ability to transmit the disease to other cattle.

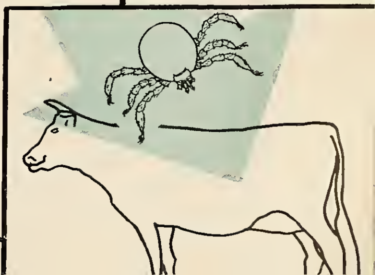
THE TICK AND THE PROTOZOAN



The tick that causes Texas cattle fever lays on the average 2,000 to 4,000 eggs. Some of the seed ticks that hatch from these in about 30 days, "inherit" the disease organism from their parent. How they do this is shown at right.


1
In the tick's digestive tract, two cells unite
2
And pass through the wall of the gut
3
Into the oviduct and thence into the ovum or egg
4
Other changes in the organism occur during development of the egg
5
And it lodges in the salivary gland of the seed tick

Thus the organism causing the disease is ready to infect a healthy cow as soon as the seed tick attaches itself for its first meal.



pastures were known to carry the disease, and northern cattle that came in contact with them often contracted it. Each year the disease was carried northward with the migrating cattle, and each year the infected area spread over a larger part of the middle southern States.

In 1889 it was discovered that Texas cattle fever was carried by the cattle tick (*Boophilus annulatus*). Shortly after, the Bureau of Animal Industry began investigations to control the cattle tick. In 1906 this Bureau and the states concerned instituted a co-operative plan for tick control. After more than ten years of study it was found that ticks could be controlled by either of two methods: (1) by use of cattle dips, which would destroy the ticks, and (2) by a rotation of pasture lands. This latter method proved practicable because the seed ticks die in a little more than two months if they cannot find large animals, such as cattle, deer, sheep, or horses upon which to live. By employing five fields and moving the herd from one to another on certain dates it was found possible to clear all the fields of ticks in from two to eight months. Although this method alone would bring the desired results, most ranchers also drove their cattle and other domestic stock through specially prepared dipping yards at regular intervals.

In order that the program might prove completely successful, it was necessary to remove all deer from the areas undergoing treatment and to prevent further entry of deer. After the areas were freed of ticks, tick-free deer were again liberated in them.

Everyone co-operated — if not wholeheartedly, at least with good grace—and the success of the program is evidenced by the fact that today cattle ticks have been eliminated from the United States.

Unfortunately, not all ticks are so easily destroyed. Up to the present, attempts to eliminate other kinds of ticks have met with little success, because their life cycles do not offer a vulnerable spot. The winter elk or horse tick (*Dermacentor albipictus*) could easily be controlled if it confined its attentions to domestic animals. But in addition to horses and cattle it attacks moose, elk, and deer. Its life cycle differs from that of most other ticks, because it develops during the winter months. Like other ticks, it lays its eggs in the spring and they hatch in about six weeks. Then, instead of going in search of an animal upon which to feed, the seed ticks bunch themselves closely together—1000 to 3000 of them in a mass—and wait until the first frosty days of autumn before they are ready to attack an unwary host that may come along. Once they find a suitable victim and attach themselves to it, they remain there until they are mature and find a suitable mate. Then the fertile females drop to the ground and find a protected place, such as a clump of grass or dried leaves, in which to pass the winter and begin the cycle all over again in the spring. The ticks remain on the animal for only six or seven weeks, so the poor victim has something to be thankful for by the time Christmas rolls around. But it may have provided meal tickets to several thousand of the bloodthirsty parasites.

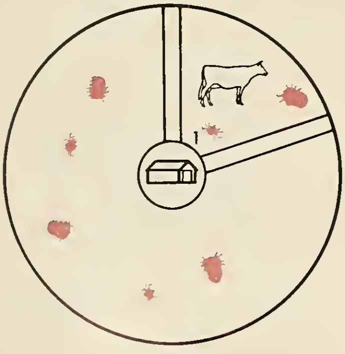
The winter tick often occurs in such great numbers that it causes the death of animals. At least 20 per cent of the moose population of Nova Scotia was killed by it a few years ago. Animals attacked become weak and sickly, resulting in a condition that is known as "tick poverty." Domestic animals can be freed of the ticks by dipping them and then keeping them warm until they have become thoroughly dried, but there is no practical way to treat the wild animals that roam our northern woods and those of Canada. It would be of indirect help, however, to dip the domestic animals annually before stabling them for winter. The winter tick also carries a disease known as tick spirochaetosis, from one animal to another, and spread of this disease may cause further reduction in our game animals.

The poultry tick (*Argas persicus*) is a serious pest in many parts of the world. It attacks its victims from June to September and passes the winter as a fertile adult. When abundant it causes tick poverty among poultry, and in the case of heavy infestation, the loss of blood may cause death. Turkeys are especially subject to its attack. In other parts of the world this tick transmits avian spirochaetosis, but not in America.

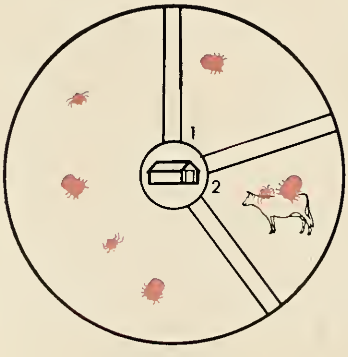
To control this pest, all roosts in the poultry house must be thoroughly soaked with kerosene, including every crack and crevice, every three or four weeks during the tick season. The birds themselves may be treated with an ointment made of kerosene, lard, and sulfur to prevent attack.

The spinose ear tick (*Ornithodoros megnini*) occurs in subtropical parts of the United States. It very commonly enters the ears of domestic animals and man, and causes deafness, serious illness, and even death, particularly when young animals are

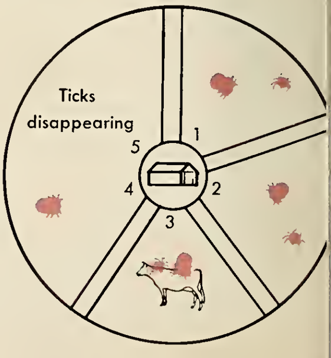
▼ As summer approaches, entire pasturage is found to contain ticks dangerous to cattle. Section 1 is therefore fenced off with double fencing 12 feet apart



▼ On June 1, the herd is moved to Field (2). Developing ticks are present in Fields (1) and (2) and attach themselves to cattle



▼ On September 1, the herd is moved to Field (3). In Fields (4) and (5), most of the ticks have died for lack of a host, without laying eggs



attacked. To destroy this tick, a mixture of one part of cottonseed oil and two parts of pine tar oil is injected into the ear, at a temperature slightly above that of the victim.

Although the ticks described above may affect our economy most seriously, dog ticks are the ones that come most commonly to our attention. There are two kinds, the eastern dog tick (*Dermacentor variabilis*), which occurs east of the Rocky Mountains, and the brown dog tick (*Rhipicephalus sanguineus*), which is known from the Atlantic coast regions and the eastern southern States, and has now become established in numerous northern cities. Both are common in the regions where they occur, and their numbers seem to be increasing each year.

The eastern dog tick is the one usually found on dogs that are allowed to run through long grass, weeds, and shrubbery. In its early stages it is found on mice, squirrels, rabbits, and other rodents. The adults attack a great many kinds of animals, from the size of dogs to deer and moose.

The brown dog tick was probably introduced from the Old World on dogs or cattle, and until a few years ago it was known only from tropical and subtropical regions in America. It is now extremely common in the New York region and is the cause of almost all the complaints in the Metropolitan area and Long Island. Since this tick is able to develop from seed tick to adult upon dogs alone, it is the one commonly found in dog kennels. When heavily infested, the dog becomes lethargic, and its coat loses its gloss. Dogs removed from infested kennels usually carry hundreds of seed ticks with them. When these drop off after completing their meal, they may cause considerable alarm, but very few of them reach maturity. They disappear into cracks and crevices in order to digest their meal and moult, and only a small percentage are able to locate the dog again. Those that do, usually attach themselves around the ears and between the toes. The adults will also attack man, and they are capable of carrying Rocky Mountain spotted fever. In removing ticks, tweezers should be used, rather than the bare fingers.

Elimination of ticks in kennels and homes is not difficult if a proper routine is followed. Since the seed ticks and nymphs remain attached to the animal for five or more days, it is possible to eliminate the ticks by employing a dipping schedule for all pets every two weeks. Ordinarily an infestation can be cleaned up in less than two months. It is good practice to dip all dogs before they leave the kennel. Similarly, when a kennel has been cleaned up, all dogs brought to it for any reason should be dipped. The dip is allowed to dry on the dogs, and it prevents re-infestation for a week or ten days.

When a large number of dogs must be treated, a vat large enough to hold sufficient material to completely cover the largest dog may be used. In the home, a boiler or tub may be employed.

The following formula and procedure has proved effective in the New York area in keeping dogs free from ticks and fleas.

Sodium bicarbonate	2¼ pounds
Arsenic trioxide (white arsenic)	6 ounces
Pine tar oil	½ pint
Water	50 gallons

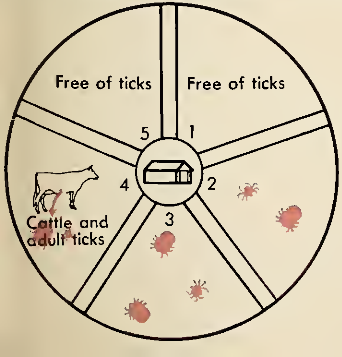
Dissolve the Sodium bicarbonate in one gallon of water and mix in the white arsenic. Add the pine tar oil and agitate until thoroughly mixed. This concentrate may now be placed in quart jars to be used as needed. One quart of it will make 12 or 13 gallons of dip. This dip will retain its strength and may be used several times if the container is covered and if sufficient water is added each time to make up for evaporation.

It requires only a minute or two to completely soak a dog. Care must be taken to see that the head becomes thoroughly wet by pushing it under the liquid two or three times. At the dilution recommended there is no danger to dogs, cats, rabbits, or other pets. However, the arsenical used is a dangerous poison, and the concentrate is highly poisonous. It should be so marked and placed in an absolutely safe place out of reach of children.

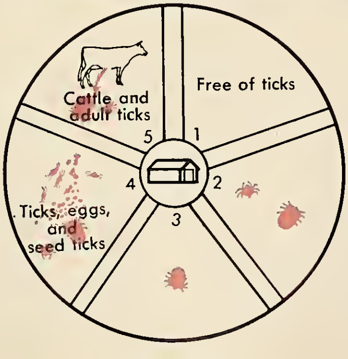
In using this dip or any of the commercial tick dips, it must be remembered that the solution must be allowed to dry on the animal, and the treatment must be continued until all trace of infestation disappears. During the warm months if a dog is allowed to run in the open, it is excellent practice to dip it every two weeks. When pets are bathed or allowed to swim, the protection provided by the dip is lost.

The presence of one or two ticks on a dog or cat is no cause for alarm. But large numbers may be present without any indication, because the ticks do not cause irritation while feeding. Dog owners may therefore be comforted to know that they can be quickly eliminated by these methods.

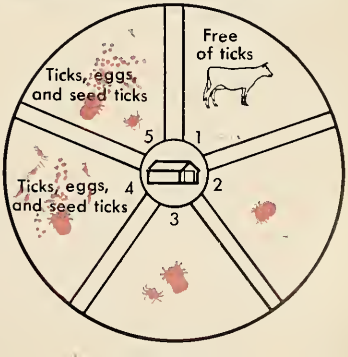
Certain other aspects of ticks and human welfare will be discussed in the next issue of NATURAL HISTORY Magazine.



On September 20, the cattle ave been in Field (3) 20 days and re moved to Field (4), where cks have died for lack of a host. icks on cattle drop off to lay eggs



▼ On October 10, the herd is moved into Field (5), which is free of ticks. Cattle are left there 20 days until remaining ticks have dropped off to lay eggs



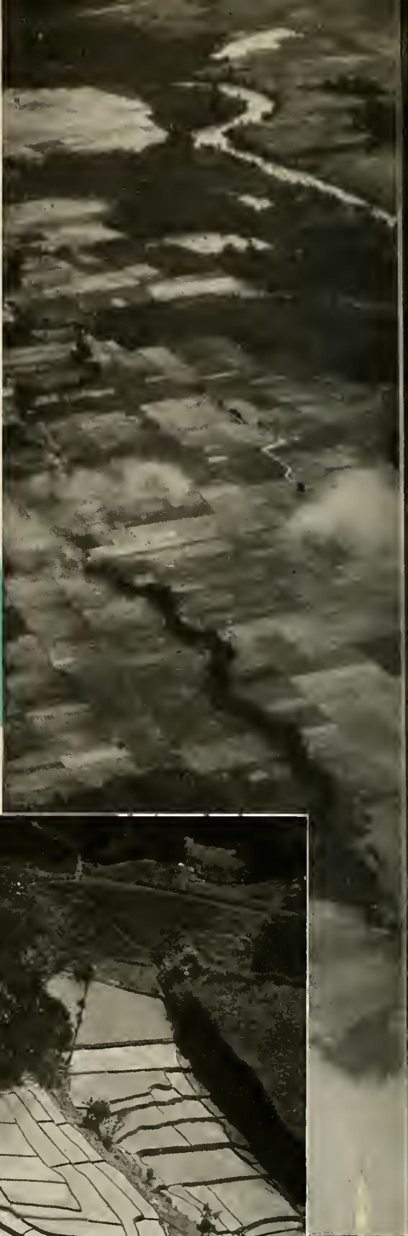
▼ On November 1, the cattle are free of ticks and can safely be moved back into Field (1). Field (2) will be free by July 1 the following year, and others in rotation. Tick's life cycle varies with climate, and this diagram is somewhat generalized; but with minor adjustments the procedure is successful

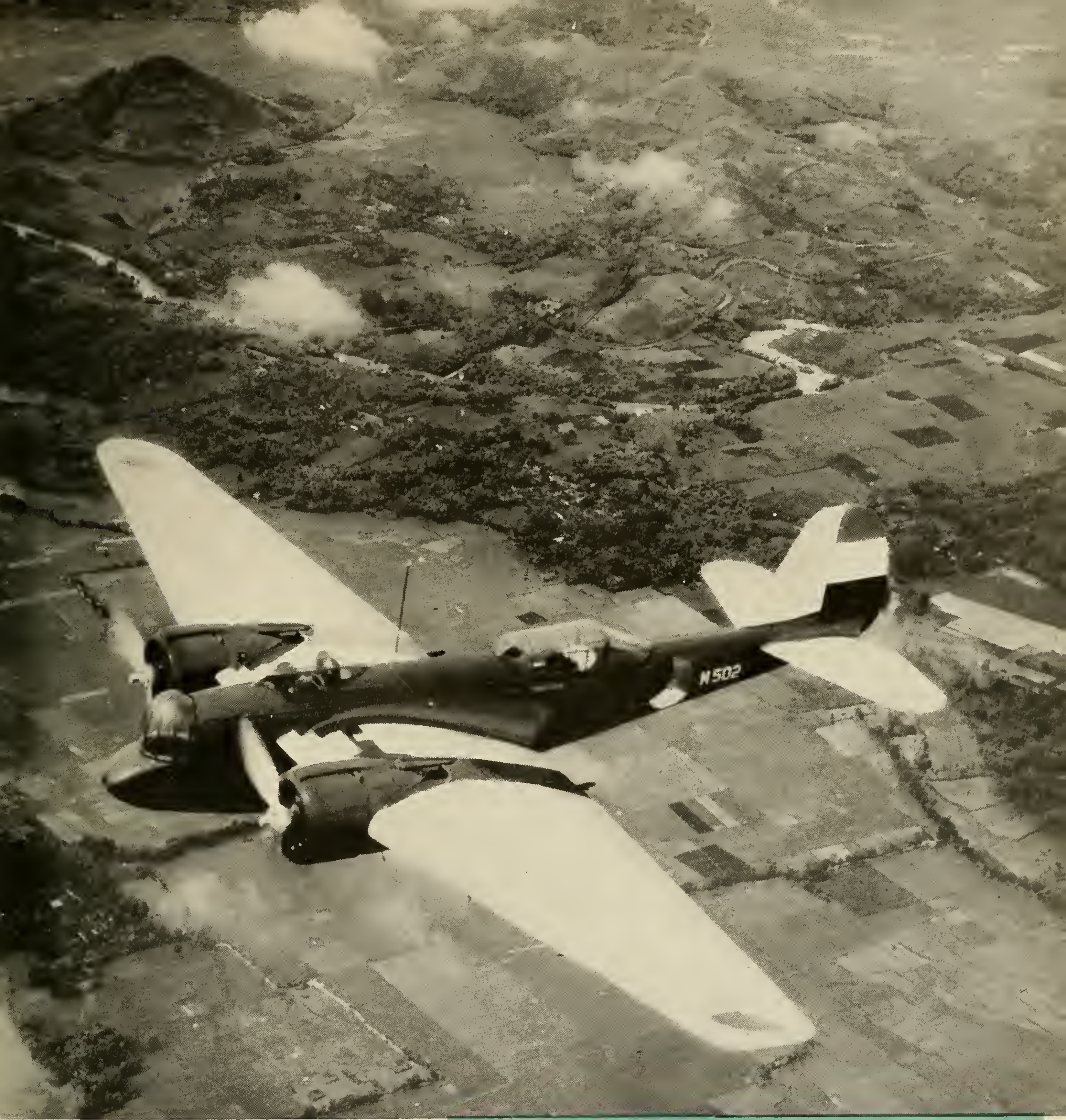
The Netherlands East Indies — *ISLANDS OF THE PAST*

A Photographic Series by HORACE BRISTOL

From Three Lions

Today the Netherlands East Indies, constantly in the news, are very much in the present—yet the customs and economy of their people reveal an elaborate ancient culture that has resisted centuries of turbulent change throughout the rest of the world. Few influences of modern civilization have intruded—present-day curiosities among the ancient and eternal rice terraces that grace the land like giant stairways from the valleys to the sky





▲ An aerial view of West Java, showing rice fields and hamlets near Limbangan

◀ Rice terraces of West Java. A hamlet lies among the trees in the curve of the railroad track

Rice is the great staple fruit of the East Indies. Its cultivation seems to have originated in China, where it goes back to the late Stone Age. Remnants of rice have been found in neolithic pottery in China, dating probably from the end of the third millennium B.C. There are good reasons to assume that the ancestors of the Malayo-Polynesian peoples brought the art of rice cultivation with them when they invaded the East Indies Archipelago from the mainland of Asia in the third or second millennium B.C.

Rice is grown either in dry fields planted in clearings in the woods, or in flooded fields (*savahs*). The latter system prevails in Java and Bali. Sometimes whole hillsides are converted into terraced and irrigated fields. The water is often brought by channels from considerable distances. Its proper distribution among the individual farmers, as regulated by customary law, is one of the chief tasks of village councils and village officials.

◄ FIRST STAGE in the planting of rice in central Java: plowing the field with oxen

▼ THE RICE PLANTS are first grown in seed beds and later transferred to the *savahs.* The Javanese woman shown here is engaged in this work. As can be seen, the rice terraces are in various stages of growth

▲ Rice fields in Java. The men working in the fields wear bamboo hats known as *chapil*. Both men and women carry small knives, called *ani ani*, with which each stalk of rice is cut individually

➤ A young Balinese girl, probably tending the ducks in the upper right-hand corner. In the background is a wet rice field

◄ Typical rice terraces in East Java. On the top of the mountain, corn has been planted. The trees in the background are cocoanut palm, betel nut, and sugar palm. Bananas and mangoes are growing in the foreground

▼ HARVESTING RICE. This is the traditional way of bundling the rice and carrying it in. In the right background is seen a small watchhouse, or *gubug*

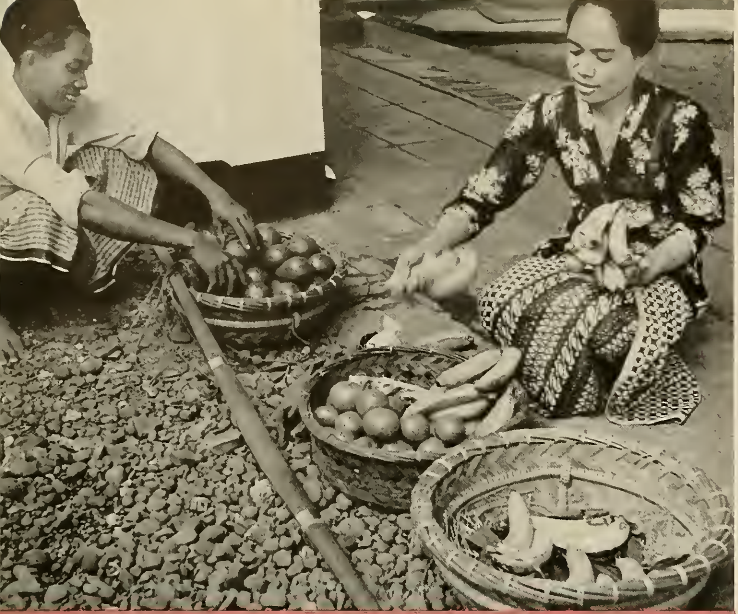
▼ AFTER being carried in from the field, the rice is put in tall stacks, built up around a wooden base. A scene in the northern part of West Java

▲ A closer view of the huge rice stacks shows their nice symmetry. In the background is a rice mill

Rice sheaves in West Java. The fields are privately owned, and women well as men work in them. This Javanese woman is wearing a batik rt and a printed cotton blouse. Batik is a form of dyeing in which all rts of the cloth that are not to be dyed are covered with melted wax. e cloth is then dyed and put into boiling water to wash out the wax

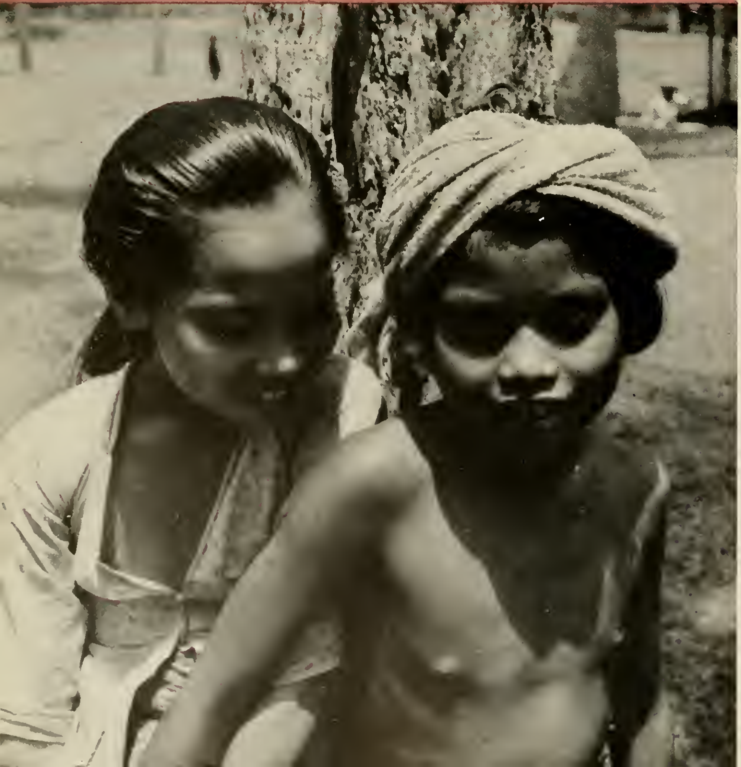
▲ Polishing rice in the *gubug,* or watchhouse. Women pound rice stalks in hollow wooden blocks, using large wooden pestles. The chaff is fed to fishes that are bred in the flooded rice fields as a secondary crop

▼ Sorting rice in West Java: an occupation in which the entire family is sometimes engaged. Rice is grown throughout the island

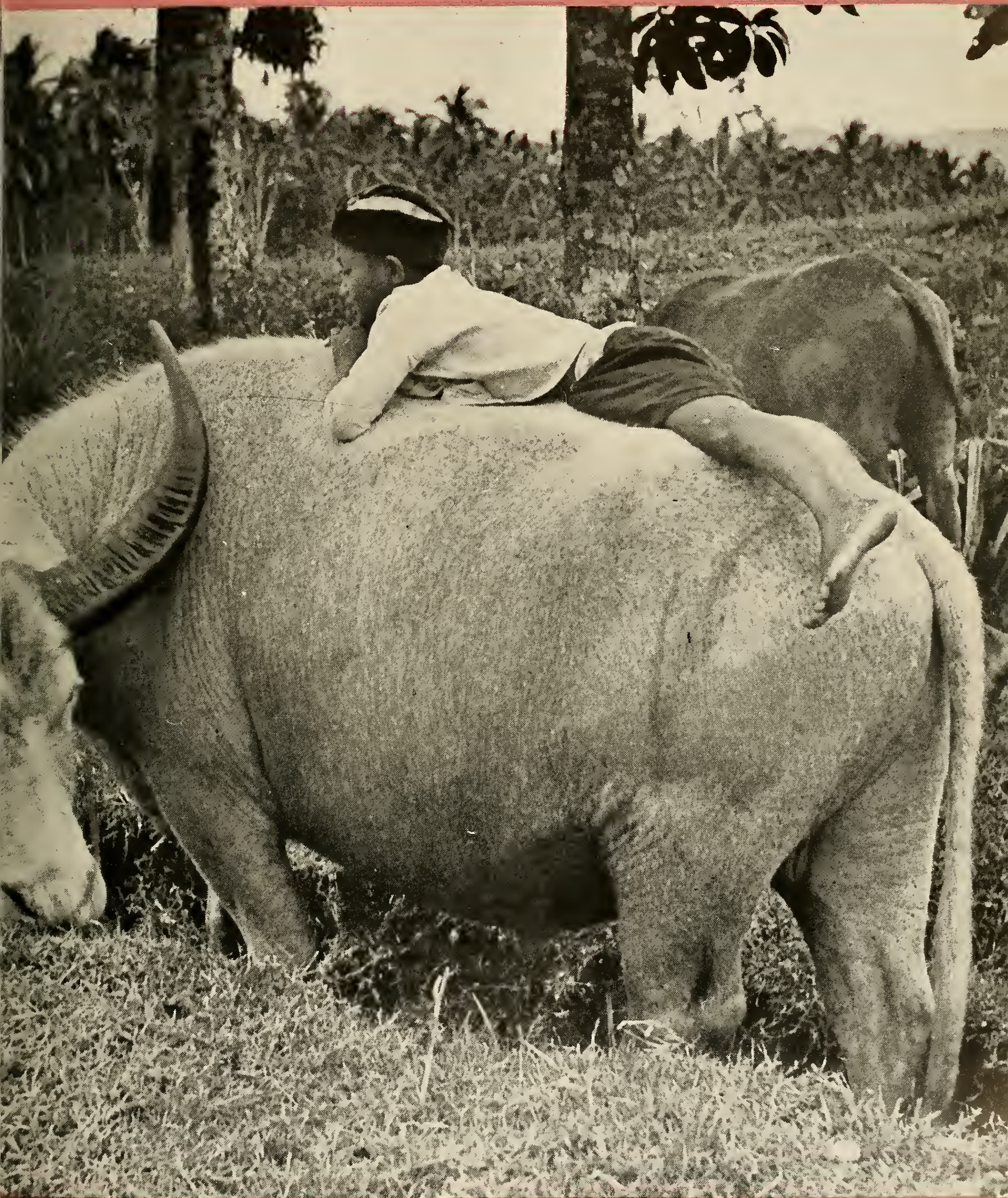


◂ A FRUIT VENDOR in West Java, with his baskets of bananas, avocados, and tomatoes, which he carries on the long pole. Each day he serves his regular clientele. The cook is making her selection

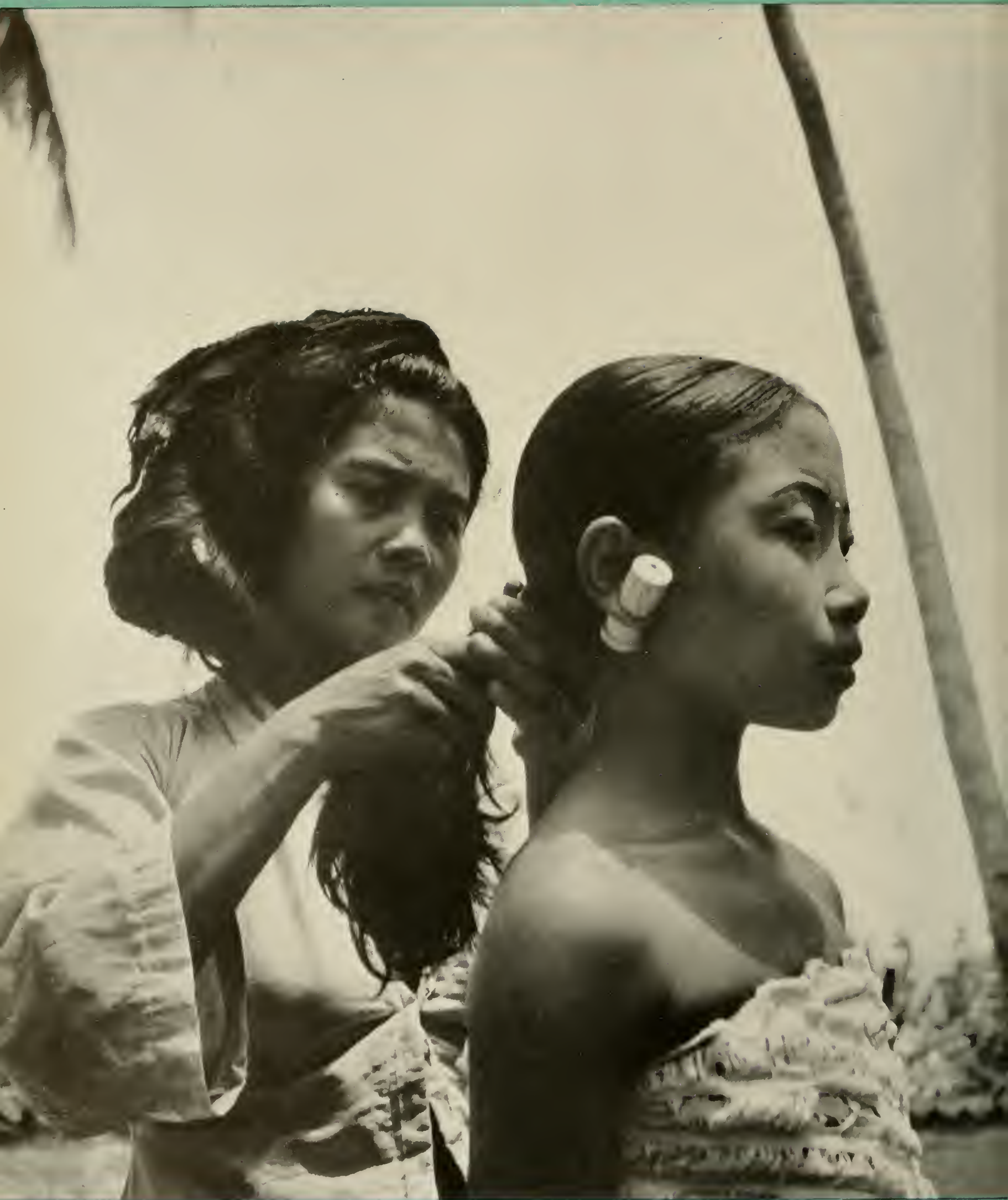
▾ BALINESE GIRLS. The ear-lobes are pierced in infancy and the holes gradually enlarged. Usually the ear-plugs are rolls of *lontar* (dried palm leaves), as in this photograph. More rarely bamboo ear-plugs are used. On festive occasions they are replaced by cylinders of beaten gold



▾ WHITE WATER BUFFALO in Java. Favorite sport of small boys in Java is to herd water buffaloes and ride on their backs, playing flutes. In the rear are cocoanut trees



▼ A **Balinese mother** dressing her daughter's hair. The ear plug is of bamboo in this instance.

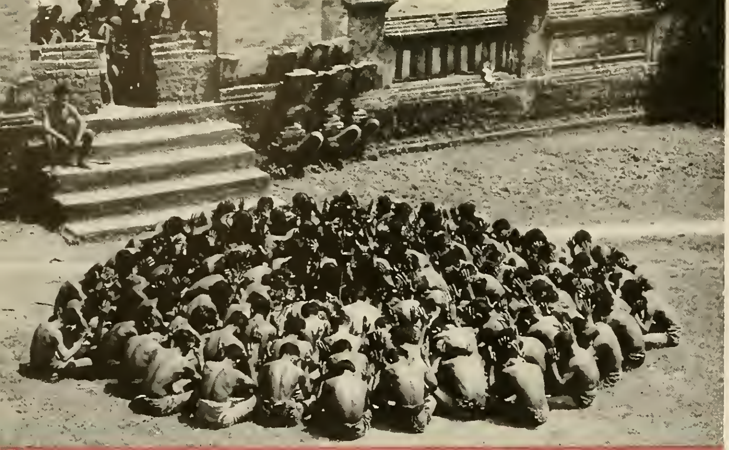


▲ BALINESE GIRLS between the ages of 8 and 15 preparing themselves for a festival

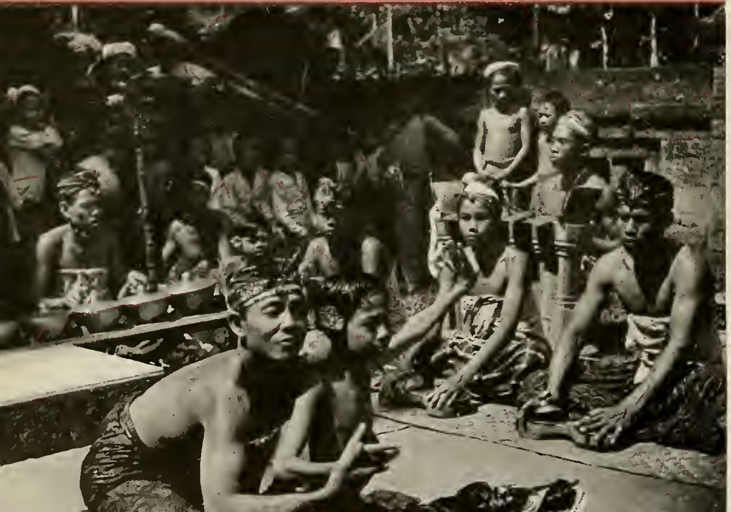
▼ A PURA, OR TEMPLE, on Bali. Corn can be seen growing in the yard at the left. In the background is a minor temple

THE Balinese are the only people in the East Indies Archipelago who have retained the Hindu religion, which in the other islands has long since succumbed to Islam. The Hindu religion and the caste system were introduced into Bali during the first centuries of our era, possibly directly from India, and later were reinforced and modified by influences and immigrants from Hinduized Java.

Balinese Hinduism is strongly



▲ BEGINNING OF THE "KECHAK," sometimes called the "monkey dance drama," in front of a Balinese temple. The dance is performed solely by men and normally by night in the flickering light of a lamp, which is in the center of the circles of crouching dancers. The Kechak takes its story from the Hindu epic Ramayana. Sita, the wife of the hero Rama, has been abducted by the demon king Ravana. The monkeys help Rama to invade the demon island and to recover Sita. The Kechak dance represents in a rather vague way some of the battle scenes in the war between the monkey armies and the demons. Originally it may have been developed as a rite intended to exorcise and drive away evil spirits

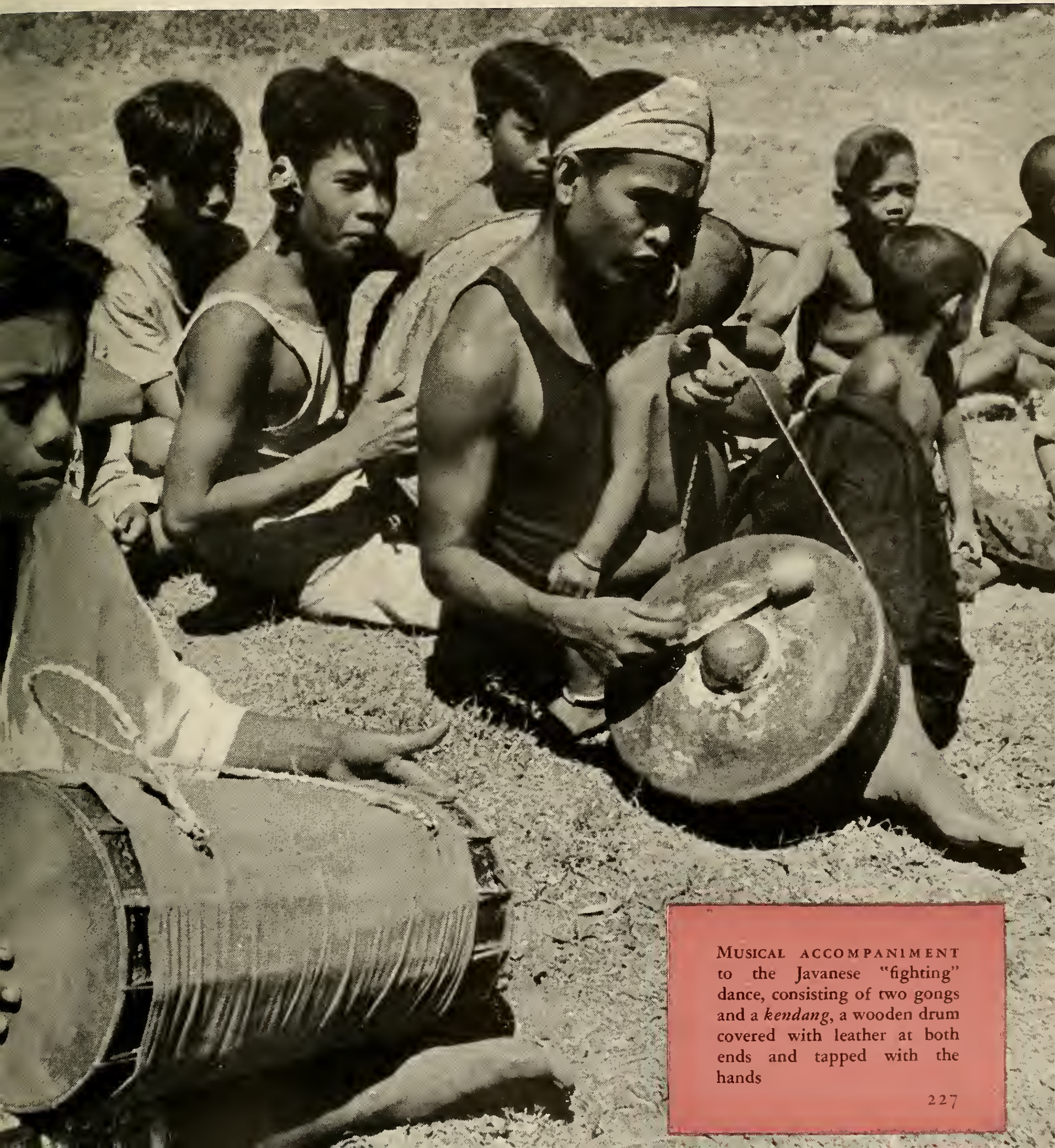


▲ A TEACHER in Bali instructing a young boy in the Kebyar dance. The word "kebyar" means to burst or explode: the bursting open of a flower. The Kebyar was developed by the famous Balinese dancer Mario less than 30 years ago. It is performed in a sitting position. The musicians on the left are playing the *reyong*, an instrument consisting of a set of gongs, while the musician on the right is playing the *cheng-cheng*, a kind of cymbal

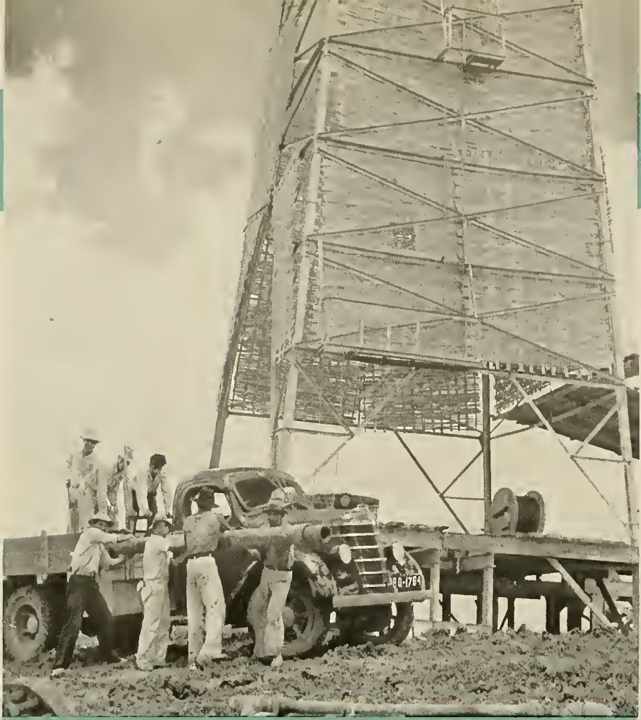
mixed with old indigenous elements, animism, ancestor worship, the cult of minor local godlings, etc. The number of temples is very large. The one illustrated on page 225 is a modest village temple. It contains a *meru*, a pagoda-like tower with tiered roofs covered with palm fibers. Its name, as well as its form, implies that it is a symbol of Mount Meru, the mountain that according to Hindu cosmology rises in the center of the earth and bears on its summit the abode of the gods. A *meru* contains no idols. In accordance with its symbolic meaning, the gods are supposed to dwell on its summit. They are represented by nine precious stones which are placed in a cavity at the top of the central pillar supporting its roof: one in the middle, for the highest god, Shiva, and the other eight surrounding it and corresponding to the eight gods believed to rule over the eight main directions of the world.

The gate giving access to the courtyard resembles a tower split in two halves and pushed apart. This gate, too, is mostly explained as a symbol of the cosmic mountain. According to Balinese legend, God Shiva transferred Mount Meru to Bali, at the same time splitting it in two and setting the two halves down as the island's highest peaks, Gunung Batur and Gunung Agung.

The minor temple in the background of the photograph on page 225 lacks the *meru* but has a "split gate."

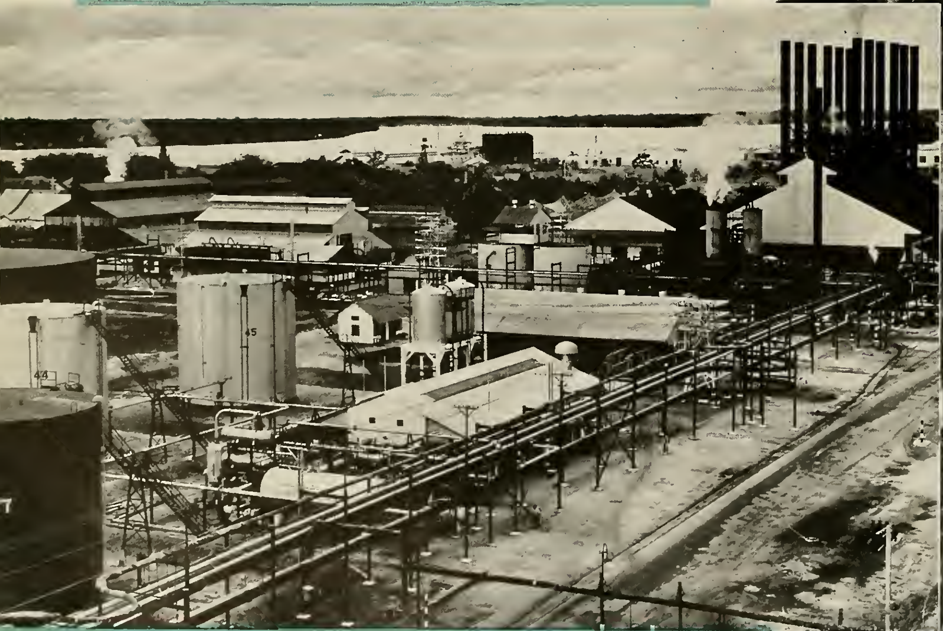


MUSICAL ACCOMPANIMENT to the Javanese "fighting" dance, consisting of two gongs and a *kendang*, a wooden drum covered with leather at both ends and tapped with the hands

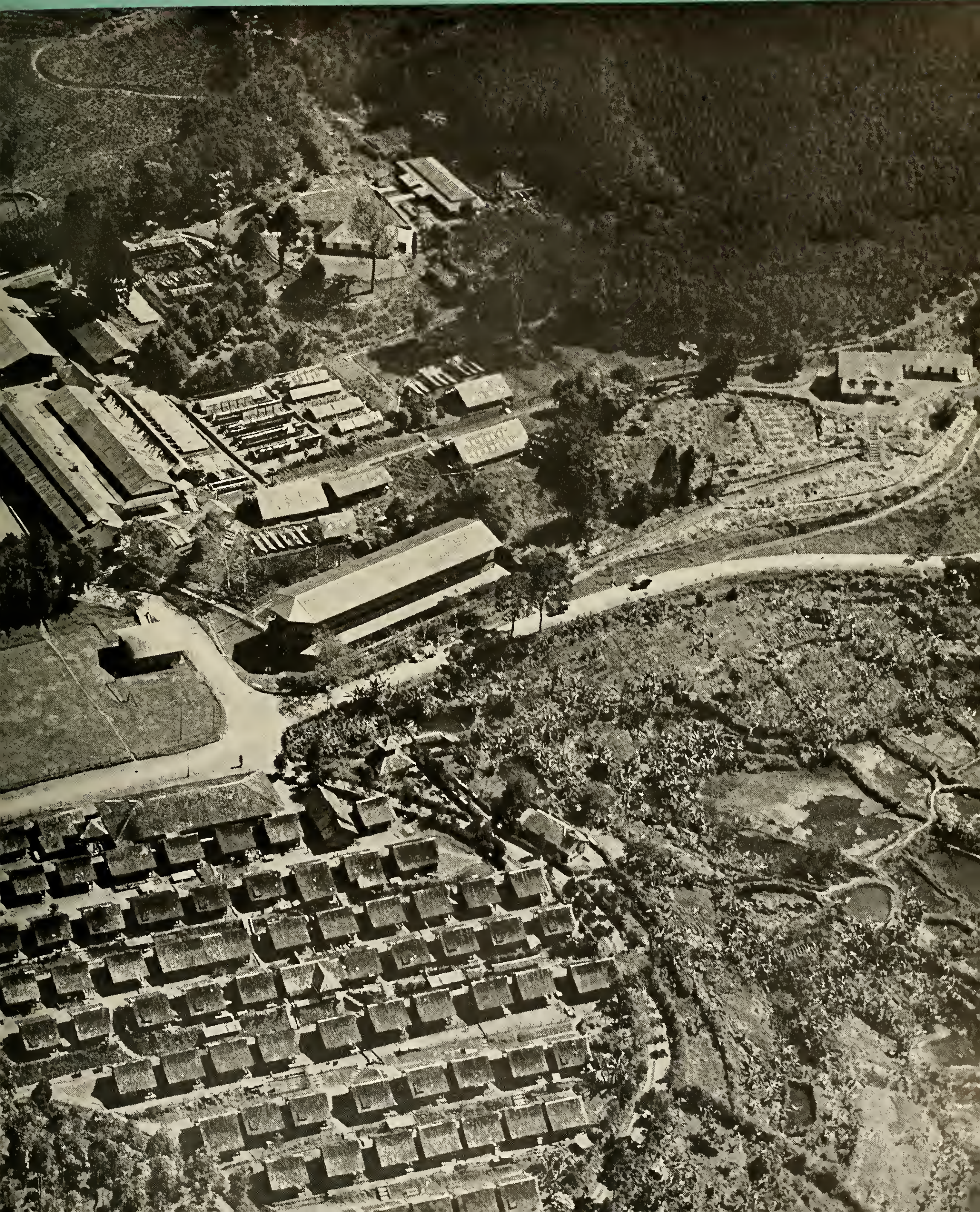


▲ Oil derrick in Sumatra. The derrick is made of bamboo, and the small cage projecting from the upper front is known as the *gedek*

▼ Oil refinery at Palembang, Sumatra, near the Moesi River



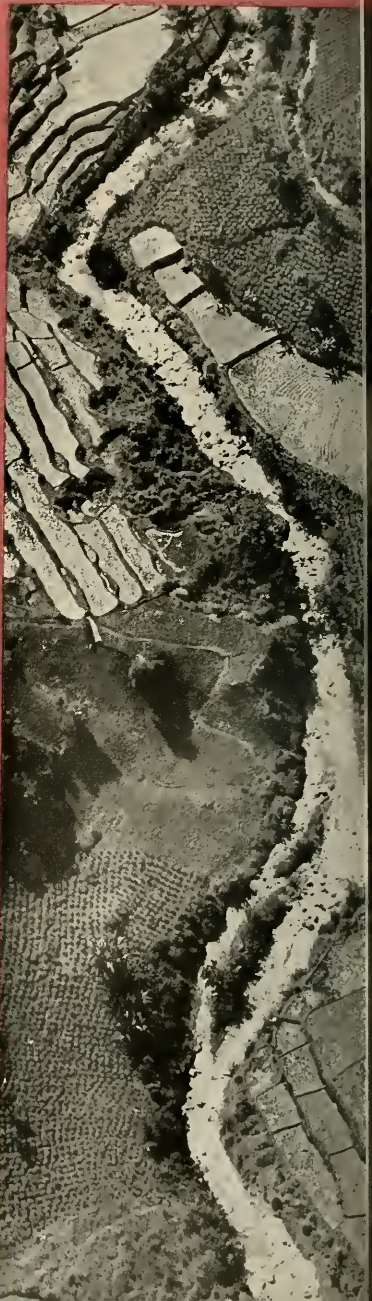
▼ A RUBBER PLANTATION in Java. In the lower front are the workers' homes, to the right of which are the small plots of cultivated land used by the rubber workers. Beyond is the administration building



▲ Sheets of crude rubber being stretched in a small rubber factory in Java. Both men and women are employed

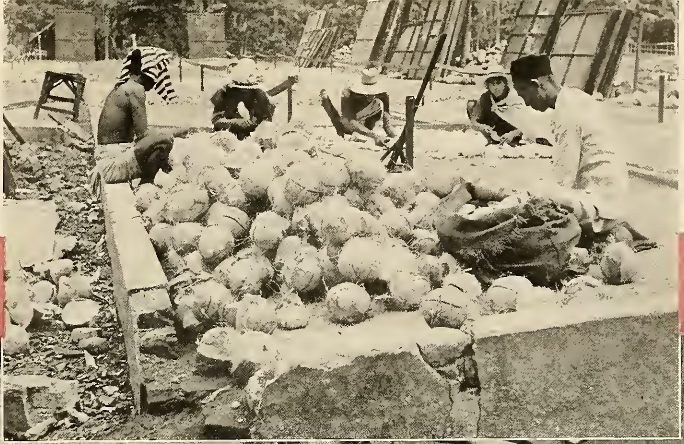
▼ Cinchona trees in West Java. The native is cutting selected trees down at the roots. The bark is then peeled, and quinine is made from it

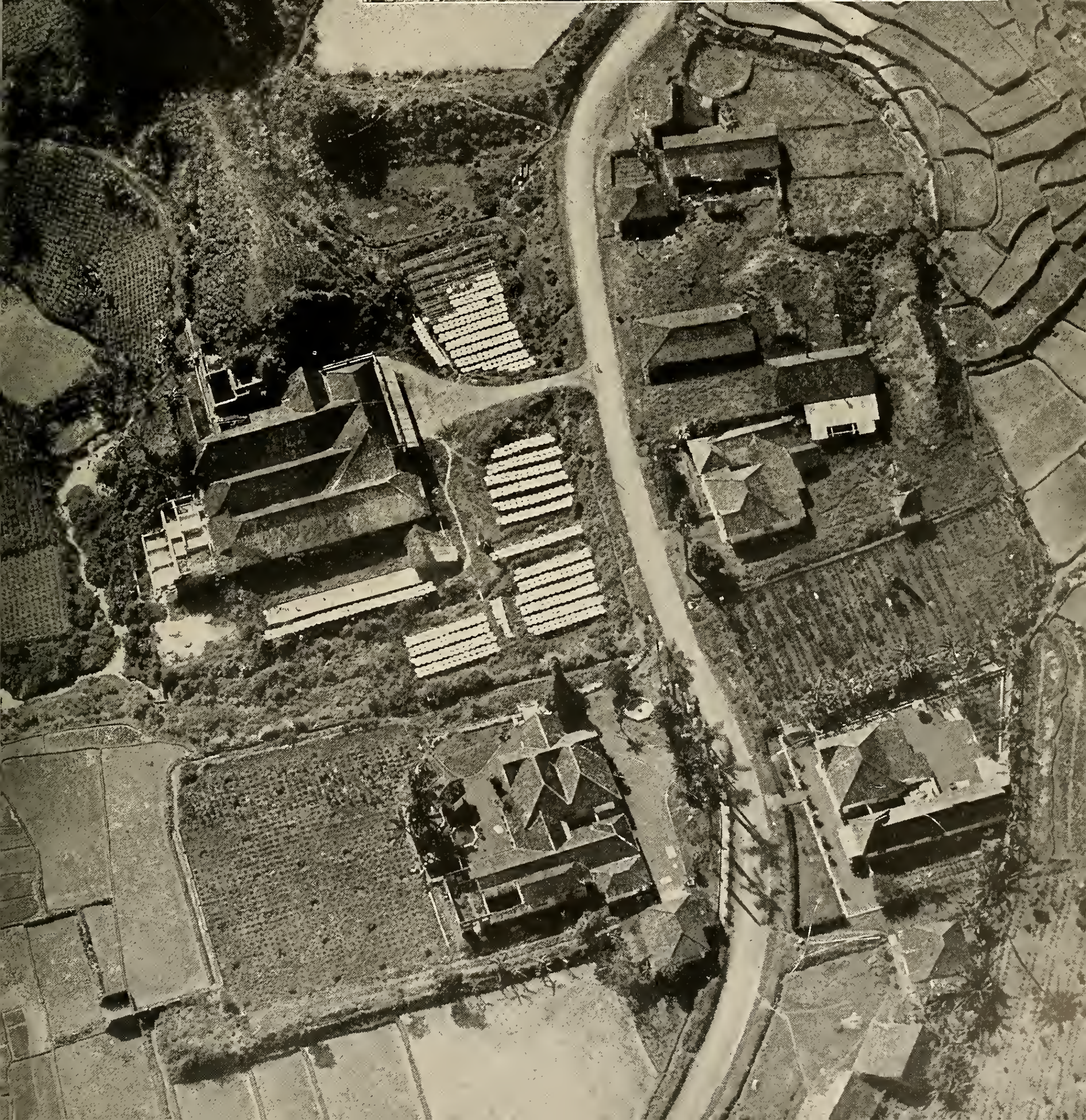
▼ Tapioca and starch factory owned by Chin
in West Java, near Pedalarang, on the road
Batavia. The white areas are the cassava (starc
plants drying, and the dark, dotted areas are t
growing plants. In the foreground are wet r
fields. A water reservoir is visible in the backgrou



Coconut factory in Java. The coconuts e first cracked across the shell, then the eat is cut out and dried to copra, from hich coconut oil is extracted. The wooden d glass frames seen in the rear and along e sides are the drying frames, upon which e coconuts are placed at night when they e taken inside the factory.

Thus do the customs of a rich and colorful lture blend with modern ways in a region hose future is being strongly molded by the pid flow of current events





ARE YOU AFRAID OF SNAKES?

By WILLIAM CARR

Director of the Bear Mountain Trailside Museums and Associate Curator, The American Museum of Natural History

Like the newspaper reporters who took time out in this article to ask some basic questions, you may find that, though you don't have to learn to love the lowly snake, he isn't such a bad fellow, after all

We were seated at luncheon, with a group of newspaper people, in the Bear Mountain Inn, overlooking the Hudson River. Somehow or other the conversation swung around to snakes, no particular snake, just snakes.

A reporter from the *New York Times* told the story of a small, persistently struggling snake caught in a spider's web, a story that had appeared in virtually every newspaper in the land a short time before. Photographs of the web, the snake, and the spider had been published in Europe and in far-off Australia.

A man from the *Herald Tribune* said that his paper had received so many letters of inquiry regarding the authenticity of the account that news bulletins were published day by day. The Association for the Prevention of Cruelty to Animals finally ended the story by removing the unhappy snake from the web. He remarked, "People are certainly interested in anything that has to do with snakes."

The *World-Telegram* spoke up "People may be interested, right enough; still they don't like snakes."

We inquired of the *New York Sun* representative whether or not she liked snakes. She answered, somewhat peevishly, "No, as a matter of fact, I despise them. Is it necessary to care for them whether you want to or not?"

"Of course, it's not necessary!"

"Well then, why is it always said, 'Really now, you should overcome your fears, it will be good for you.' As a matter of fact, I believe that people who profess to like snakes are abnormal! And while we're at it, I think you should know that I really don't fear snakes. I simply dislike them!"

"I'll wager you visit the snake house in the Zoo just the same," laughed the *Herald Tribune.*

The *Sun* admitted that she did and also conceded that snakes were often beautifully colored.

The *Times,* amused by this, was of the opinion that people who abhorred everything concerning snakes frequently visited snake houses regardless. He believed that some persons enjoyed shuddering.

"Many people shudder because they think it is the 'thing to do,'" said the *Tribune,* cynically.

The *Associated Press,* quiet until now, put down his soup spoon. "I can trace my dislike for snakes back to the time when I was a little boy playing in a hay field up in northern New York. I'll never forget the terrible experience of having a defunct Garter Snake tossed at me by a farmer, raking near-by, who had just killed it. You couldn't get me near one of those things after that."

The *United Press* failed to see anything abnormal about people who were interested in snake habits or who handled snakes. He thought that small boys who carried snakes in their pockets were as "normal" as could be.

The *Sun* had an answer, as usual. "I suppose you were one of the aforementioned 'small boys' who endeavored to frighten the teacher to death by bringing snakes into the classroom. Now confess, weren't you?"

"Well, what of it!" admitted *United Press.* "What if I did? Was that so much out of the ordinary?"

"No, not at all, but just because you don't happen to dislike snakes, please don't lose sight of the fact that others do!"

"I was fully aware of that fact! Why do you think I brought them to school!"

"One of the most unfortunate things one may do is to force a snake upon someone unexpectedly or against their wishes," we said, "especially if you are trying to help them overcome a fear of reptiles."

"Oh! So you're one of those people who try to make people like snakes whether they want to or not!" said the *Sun* witheringly.

"Absolutely not!" we returned with what we hoped was sufficient indignation to overshadow the wither.

"We are just here, and so are the snakes, that is all. When visitors come to us and exhibit interest, we merely like to assist them in any way possible. We have a large snake pit near the Bear Mountain Trailside Museums, a ten-minute walk from where we are now seated."

"I suppose you go forward with the idea that a little genuine information may aid people whose fear is largely the result of wrong impressions," said the *Times* understandingly.

"Exactly!"

"Lack of information isn't the only thing that is responsible for snake fear," said the *Sun,* persistently.

"We are well aware of that," we replied. "Nevertheless, when a visitor to our Zoo tells us that one of the principal reasons she dreads snakes is because she believes them to be slimy, we think that the very simple expedient of convincing her that they are not slimy is decidedly worthwhile."

"Then what!" inquired the *Sun,* a newspaper woman to the core.

"Well, after that we encourage the new recruit to hold a snake so that she may discover at first-hand exactly how it 'feels.' Mind you, we suggest this idea. We don't force it."

"I should hope not! How many converts do you make?"

"About eighty per cent."

"I don't believe it!"

"You really don't have to, you know. You're nothing if not frank."

"I am surprised, that is all!"

"So were we when we commenced this type of work."

"Are you more successful with men or with women?" asked the *Tribune.*

"Women are by far the most easily convinced."

Disbelief once more crossed the face of the *Sun,* but she remained silent.

"You have only told us a slight bit about your methods of introducing snakes to people. What is the whole procedure?" asked the *World-Telegram.* "You probably couldn't convince me anyway, but let's hear it!"

We explained, to begin with, that all of our staff who lecture about snakes, know beforehand that there are about twelve questions that the average visitor is apt to ask in relation to the snake exhibit. We added that as a consequence of this, when a crowd has assembled at the pit, the man in charge gives a preliminary talk during which he includes the points already on people's tongues.

"Don't you take quite a lot for granted?" asked the *Sun.*

"No, experience has proved that we do not."

"What are your twelve points?"

"The absence of slime is one, and the difference between poisonous and harmless snakes is another."

Photo by Frederick Poestoke

MOUNTAIN
OOLOGY MUSEUM
jointly by
Natural History
Interstate Park
Free

"Somebody tried to tell me that all snakes are venomous in one degree or another," said the *Herald Tribune.*

"Even I know better than that!" said the *Sun.*

"Good!" returned the *Tribune.*

"There are only two poisonous snakes here in the Northeast, the Rattlesnake and the Copperhead. All the rest are harmless."

"I'll wager you have that on a label near your snake pit," laughed the *Sun.*

"You win the wager," said the *Associated Press.* "I saw the sign there myself! By the way, how do you tell a poisonous snake from a harmless one?"

"In this section of the country, the two poisonous snakes we mentioned are known as 'pit vipers.' This is due to the presence of a small depression or 'pit' between the nostril and the eye. Also, the Copperhead and the Rattlesnake both have elliptical eye pupils. In other sections, you have to look out for some other kinds of snakes."

"That's fine," said the *Sun,* "but how often does a person come close enough to a snake to look into its eyes and examine its pupils? If I saw a Rattlesnake, how would I know it?"

"It might help if you would stop, look, and listen for the rattles!" suggested the *World-Telegram.* After all, Rattlesnakes do have rattles, I suppose!"

"How about Copperheads though," asked the *Sun,* no whit abashed. "I've heard that you can identify them by the 'cucumber smell,' but suppose the wind is blowing in the opposite direction?"

"It doesn't make the slightest difference which way the wind is blowing. There is no 'cucumber' odor anyway! The best system is to learn to know the Copperheads' markings or color patterns. The colors vary, by the way, from browns all the way through to copper and amber. However, there is an 'hour glass' pattern on the snake's body that once well observed, is not easily forgotten. Also the snake's body is usually rather large in relation to its length. The tail is short and thick."

"Is it true that you can always know a poisonous snake by the 'diamond shape' or 'triangular shape' of its head?" asked the *Tribune.*

"No indeed. Many perfectly harmless snakes have a so-called 'triangular shape'! The harmless hog-nosed snake and the equally non-poisonous common water snake are two examples. You cannot consider the shape of a snake's head as a criterion to its being poisonous or non-poisonous."

We further explained that there were poisonous snakes that lacked 'triangular' shaped heads, for example, the Coral Snake of the far South.

"How about snakes jumping up and biting your hand?" asked the *Sun*.

We answered this by telling that the question of snakes' aggressiveness or lack of aggression usually came second or third on our list of twelve. We added that as far as we knew, there was no local snake that would jump up and bite.

In the first place, the reptile finds it necessary to keep a good portion of its body on the ground when it strikes, and secondly, none of our local snakes go out of their way to make trouble. Their principal aim seems to be to escape detection and avoid danger. When cornered, some of them will do battle, but when unmolested they behave in a most exemplary fashion where human beings are concerned.

"Don't tell us that you are one of these fanatics who think that snakes should not be killed!" exclaimed the *Sun*.

"Harmless snakes should most certainly not be killed, fanatic or no fanatic. It is a matter of common sense."

"I didn't believe any mind could be so warped!" mourned the *Sun*. "Honestly now, is there any legitimate reason why snakes should not be killed? If I were crossing a field and were to come upon a Garter Snake in my path, would it not be the right thing to pick up a stick and destroy the snake once and for all? I've often done it! Don't try to tell me that I should leave the snake alone simply because its ancestors traveled the earth long before mine did, or that it has as much 'right' to life as I have!"

"There are more reasons than that, The truth is that snakes have their own economic value. They really 'belong' in the scheme of things and should no more be exterminated than should hawks or owls, for instance."

"I thought hawks and owls were considered harmful and that they should be killed off," said the *United Press*.

"Confound it! That's what really makes us angry! Why is it that people who should know better take it upon themselves to sit in judgment upon various species of animals, simply because they have 'heard so and so'? When man takes over a section of woodland for a park or for other 'game protective' purposes, he only too often feels that he must 'help out' the creatures he likes best by slaughtering their supposed enemies.

"Furthermore, if you fellows would publish a few pictures of snakes once in a while, it would help to dispel a lot of needless fear. You refuse to have anything to do with a snake story, and as a result we have the same erroneous superstitions about snakes that we did generations ago. It's positively medieval . . ."

"Gather around boys, we've got him going," laughed the *World-Telegram*.

"Why can't things be left as they are—snakes, hawks, foxes—they all contribute definitely to the balance by naturally reducing species that might become too prolific. They feed upon mice, small birds and many other creatures, and, on occasion, upon each other. We really do not know exactly how much good or harm they do. However, there are so many reasons for not molesting them that the arms manufacturers' plea for bigger and better extermination would be rather pathetic were it not for the tragedy of the thing. We could talk for hours about this."

"I could believe that!" said the *Sun*, "but how about your snakes?"

"I suppose that people ask many questions about the snakes' inner workings," said the *Times*.

"Yes, they do. You would be amazed to know how many visitors seem to regard a snake as a sort of tube or hose without any notion whatever of inner organs! When we tell people that snakes have lungs, hearts, stomachs, slender ribs, and a backbone, we often hear comments such as these: 'Oh! I thought snakes only had stomachs!' 'I didn't know snakes breathed,' or 'I didn't know snakes were delicate!'"

"There is nothing startling about that," said the *Sun*. "I told you before that you take too much for granted about your visitors. Why should you expect your onlookers to be well versed as to a snake's anatomy?"

"We would at least think that our visitors would know that a snake breathed!"

"You're wrong."

"I can see that."

"You should have discovered it long ago!"

"What about this 'living until sundown' business?" asked the *Times*. "Is there any truth in the story that if a snake's head is removed, the body will survive until dark? I know it sounds like a stupid question, but I've heard it often."

"I'm surprised at you!" said the *Sun* scornfully, "and you from the *Times*, at that!"

"Then it isn't at all true?" persisted the *Times*, with less confidence.

"Of course not! They wiggle for a time, but that's only because their muscles and things are contracting," offered the *Sun* condescendingly.

"I can see that you have been hiding your knowledge under a bushel basket," said the *Times*.

"Just an egg crate," returned the *Sun*.

"And then there is the one about snakes being frightened of horse-hair ropes," said the *Associated Press*. "I've frequently heard that cowboys, preparatory to sleeping on the ground in Rattlesnake country, will take care to place a horse-hair rope on the earth around their bed, the belief being that no snake will cross the magic circle. Naturally, I don't suppose this is true, but is it?"

"The answer, again, is no!"

"I guess it's equally untrue about a snake's ability to charm people," said the *Associated Press*.

"Some folks are easily charmed!" remarked the *Sun*.

"That was not intended as a facetious question."

"I'm glad to hear it!"

We took advantage of this lapse to secure a mouthful of food and then told the *Associated Press* that according to our observations, it was quite impossible for a snake to charm a person even if the reptile so desired.

"How can you tell whether or not a snake desires something?" asked the *Sun*.

We let this pass and settled down to enjoy our lunch. We had learned, long since, that snake questions, once well under way, may flow on and on for hours, and we were really hungry!

The End

Continued from page 197

its rocks are sandstone and quartz. A ship's sails are not "reefed" as she comes into port, nor should speed be reported as "six knots the hour."

Such slips hardly affect the over-all picture, which is eminently entertaining as well as illuminating. Dr. von Hagen has a vigorous pen, lively imaginative power, and a feeling for drama. No other source, unless it be the voluminous writings of the subjects themselves, reveals more convincingly the "divine afflatus" that drove the pioneers of science through years of toil, peril, and suffering in a wilderness. Furthermore, while we usually think of Dr. von Hagen's heroes as elderly or old men (Humboldt lived to be 90), the author reveals them in all the hope and joy of their youth.

R. C. M.

HIAWATHA

with its Original Indian Legends

- - - - - by Chase S. Osborn and Stellanova Osborn

Jaques Cattell Press, $2.50
255 pages, 10 plates

THIS edition of *The Song of Hiawatha with its Original Indian Legends* is presented as an abridgment of the 700-page *Schoolcraft-Longfellow-Hiawatha*, a joint production of the same editors. The senior editor is a former governor of the State of Michigan, the Lake Superior region being the "Hiawatha Country;" the junior author,—for they are more than editors,—is his daughter. The introduction was written by Justice Frank Murphy of the Supreme Court of the United States, also a native of Michigan.

The earlier book, we are told, "included an exhaustive final refutation of the theory that Longfellow used the Finnish *Kalevala* as his source for the Hiawatha story rather than the Indian legends as recorded by Henry Rowe Schoolcraft." It is difficult to understand how it can be more of a "plagiarism libel," as the authors call it, to claim that Longfellow got his material from the *Kalevala* than to state, as the authors admit, that he got it from the writings of Schoolcraft. In either case it would hardly be plagiarism.

Whether or not the *Kalevala* was to any extent the source of Longfellow's *Song of Hiawatha*, one cannot read the former without being overwhelmed with the conviction that here is where our American poet in all probability got his meter and the form of his poem, some of the lines being almost identical. The *Kalevala* was first published in 1835, antedating the *Song of Hiawatha* by 20 years.

It was a happy thought to include in one volume, as has been well done here, the full text of Longfellow's poem, together with parallel-passage inserts from the legends of Schoolcraft. In addition there are three essays, namely, "The Hiawatha Country," "Hiawatha's People," and "The Genealogy of Hiawatha." The writing of these introductory essays is rather journalese, with many statements that verge on exaggeration. In "The Hiawatha Country," we are told that "the grandeurs of the Lake Superior region are unsurpassable;" that "the air is the clearest and most vitalizing on earth;" that "before the white men came, with pork and whisky poisoning, there were no such things as syphilis, cancer, and tuberculosis known among the Indians." It is probably impossible to prove or disprove this statement concerning cancer and tuberculosis, but, based on osteological as well as historical evidence, it is commonly believed by physical anthropologists that syphilis was here before the white man came.

In their foreword the authors say that Longfellow drew the bulk of his material from the works of Schoolcraft; and in the essay on "The Hiawatha Country," they state: "Then Henry Wadsworth Longfellow created *Hiawatha*, a diadem of literature, from the jewels that Henry Rowe Schoolcraft discovered on the shores of Lake Superior."

CLYDE FISHER.

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Foreword by Gifford Pinchot

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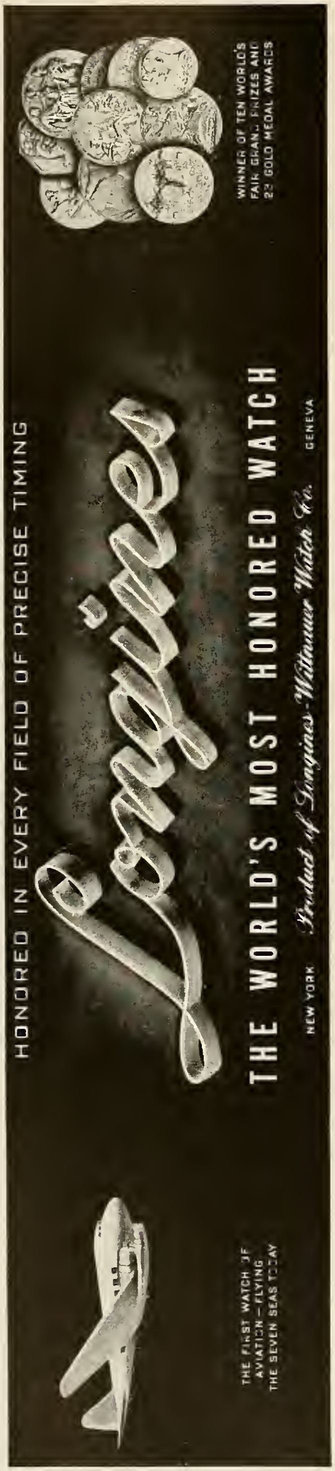

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THE FIRST WATCH OF AVIATION — FLYING THE SEVEN SEAS TODAY

WILL YOUR *GARDEN* PHOTOGRAPH?

By THANE L. BIERWERT

Acting Chief, Division of Photography, American Museum of Natural History

START your gardening this year by using your camera as diligently as you use your trowel. Visualize your garden photographically. Some views will have pictorial possibilities, others will lack interest or composition. When you have taken the pictures and studied the prints or projected slides, you will see details that have escaped notice because they were lost in the garden as a whole. Rearranging a flower border, moving a shrub, or placing more plants in a certain area may be just what is needed to improve the general appearance of the yard. Next year, when spring comes, your garden will blossom better than ever before.

Garden photography is primarily record-photography, and the results will be filed in one of several categories. We can group the prints or slides as records of plant growth during the season, as a progress series showing the stages of improvement in the attractiveness of the garden over a period of years, or to illustrate new ways of working in the garden. Visits to other gardens will provide an inspirational pictorial collection of new ideas. We do not need fancy or expensive equipment. A box camera with a chair as tripod will do. We need only an interest in our garden and a desire to have a good looking one.

If we do not use color film, we shall want panchromatic, so that every color, including red, will reproduce in its proper shade of gray. A filter is not necessary; 99% of the pictures can be made satisfactorily without one when using panchromatic film. Some sort of tripod is needed to hold the camera while we patiently wait for the breezes to subside. A cable release to trip the shutter without shaking the camera is helpful. Gather together your close-up attachments or the telephoto lens if you have one. Last and most important, keep a critical eye that will select the proper viewpoint for each photograph. It might be wise to carry along a trowel just in case a bit of transplanting will help the composition.

Now that we are equipped, let us wander into the garden. This one has a small lawn surrounded by colorful flower beds, with a tree here and there and a refreshing pool nestling at the base of a rock garden. Narrow paths guide us from house to garage, and chairs are grouped under the trees. The ever-present telephone poles and garage offer a familiar problem. Out of this mixture, we wish to picture the restfulness and peace that the garden typifies.

Fortunately, the day is slightly hazy, with soft, transparent, well-illuminated shadows. It is immaterial if the sky is not blue; we are gardening today, not shooting special effects.

For general views, a position along the pathway from the house to the garage, at a point where the garage will be outside the picture, is good. We are near a gnarled apple tree that casts a broad shadow that forms an excellent base for the picture and informs us that coolness is found on this side of the garden. Across the path from the tree is a bench, an inviting place to sit and read. Beyond is a sunlit section of the garden. This creates distance because of the change in tone and color. We stop the lens down to a small diaphragm, f 32, and give the correct exposure for that aperture. Everything in the picture must be sharp; hence the small aperture.

Now turn around and photograph toward the house. We'll have to move down the path into the sunlit area. As a foundation for this view, include in the foreground some of the dark plant masses. We can use the tree shadow again to create separation of planes. Since it should not dominate the scene,

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SPRING EXHIBIT ON BIRDS

The dove that Noah sent out to see if the waters had subsided, the wandering albatross, Long John Silver's parrot, the ugly duckling who became a swan, and the bird on Nellie's hat are only a few of the scores of birds famous in literature and music that are featured in a new spring exhibit, "Birds from Noah to Now," open to the public at the American Museum of Natural History.

As early as 50 B.C. the common sparrow inspired the Roman poet, Catullus, to write "On the Death of Lesbia's Sparrow." Ever since, birds have played prominent parts in fables, verse, and prose, and many of these famous birds in literature and legend can be seen in the current exhibit located in Roosevelt Memorial Hall. The exhibit will also contain examples showing the influence of birds in music. Rimsky-Korsakoff's opera "Coq d'or" celebrates the adventures of a rooster, and in the "Mikado," Gilbert and Sullivan immortalized the small Tom-Tit by means of Coco's comical-doleful song of Tit Willow.

An appropriate gesture to spring, "The Bird on Nellie's Hat," is illustrated by an Easter Bonnet of 1903, a concoction of biscuit-colored straw, brown ribbons, and sweeping plumes weighing more than three pounds. Another popular song of the early part of the century is depicted by a small, sad goldfinch perched in a gilded cage.

The exhibit will be on view through May.

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we shall screen the house behind the tree. For both of these pictures, it is imperative that the yard furniture be artistically arranged or removed entirely.

Little things like dead branches or weeds that may not be noticed in daily life are all too evident in a large print or when the slide is viewed from the screen. We can readily make our garden look better than it actually is, because we can hide the undesirable elements and clean up the grounds as we go along.

If we are photographing across sloping lawns, the camera should be looking uphill to give height to the composition. Paths will sweep more gracefully; trees and shrubs will stand straighter and higher. Rock gardens, too, are photographed best from the lower side because then we can see the ledges and look into crevices where plants are nestling.

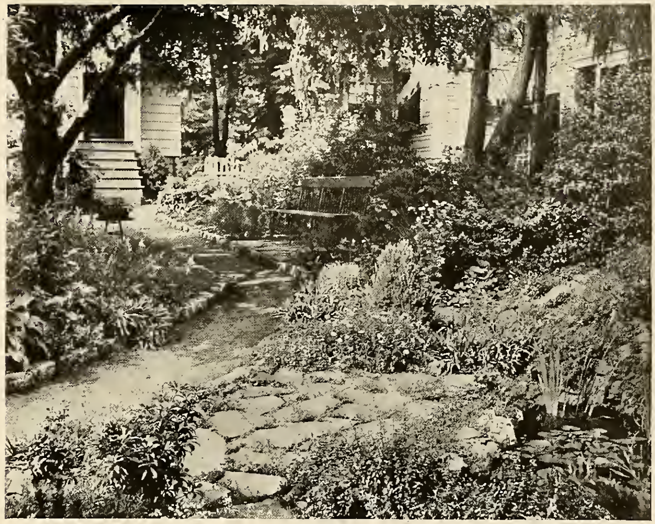
Small vistas in the garden should not be neglected—sections that may not figure in the bolder composition of broader views.

For close-ups, the technique is similar to that for wild flowers. Fill the picture area with the flower or plant. Photograph from near "plant eye level" where possible. This angle of the view shows the stem and the surrounding verdure to better advantage. If the camera is pointed down at the plant, it is fore-shortened. Natural backgrounds are preferred. To darken a sunlit area, cast a shadow wherever you need it. There should be no doubt as to the best hour in your own back yard. You will soon know the precise minute when each plant looks best.

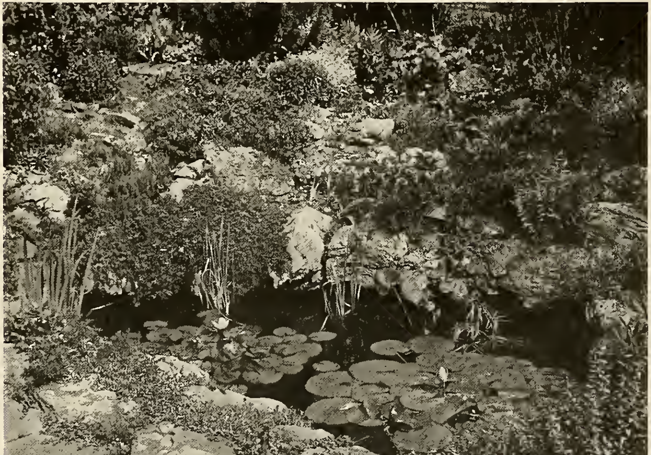
Close-ups are the accent or spice of a garden series. The soft, subtle views that blend are much more fascinating. It is the flower that fills the picture that is remembered, not the screaming colors. As soon as a gardener sees a strong color clash in a color film he will do a bit of transplanting. Only perfect specimens should be used. It will be necessary to photograph before the insects and the wind and rain have had a chance to damage the flowers. In making a sequence of pictures of one subject, take each photograph from the same spot. Drive a stake in the ground as a marker. If each exposure embraces the same area and is illuminated from the same angle, the plant will not appear to jump around but will gradually grow in one place.

The greatest pleasure of garden photography is visiting other gardens. Neighbors are always honored when someone shows an interest. If you belong to a garden club and have successful results with your photography, you should show your pictures to the members. Both your photographic and gardening knowledge will grow, and you will soon know how to protect tulips from mice as well as how to make the strong colors register in all their glory on color film or as subtle shades of grays.

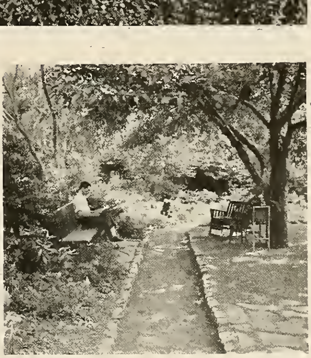
If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.



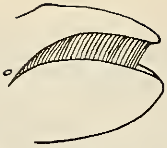
▲ FLOWERS and bushes make a rich and appealing foreground, while just enough of the house appears to stabilize the background. The combination of trees, bench, and angular pathway offers an interesting picture, and the alternating planes of light and shadow add variety to the composition



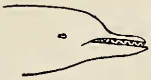
▲ WHEN PHOTOGRAPHING a sloping lawn or rock garden, a better effect will be obtained if the camera is looking uphill. This imparts height and makes the various levels of vegetation more easily distinguishable



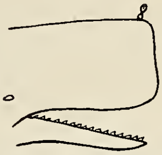
➤ A PATHWAY, the cool shade of a large tree, and some attractively arranged lawn furniture provide an inviting scene. The patch of sunlight in the background relieves the composition and gives greater distance to the picture



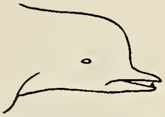
1. WHALEBONE IN THE MOUTH
(Right Whales)



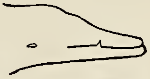
2. TEETH IN BOTH JAWS
(Certain Porpoises
and Dolphins)



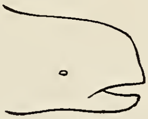
3. TEETH IN LOWER JAW
ONLY, BUT MORE THAN
TWO OR FOUR
(Sperm Whales)



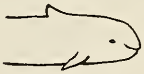
4. TEETH, ONLY TWO OR
FOUR, AT THE END OF
THE LOWER JAW
(Bottle-nose Whales
and other species)



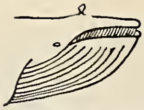
5. TEETH, ONLY TWO OR
FOUR, IN THE SIDE OF
THE LOWER JAW
(Beaked Whales)



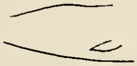
6. NO TEETH NOR WHALE-
BONE IN THE JAWS
(Narwhal, female)



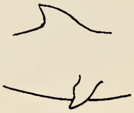
7. THROAT SMOOTH
(Black Fish and
other species)



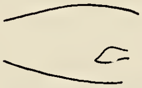
8. THROAT WITH FOLDS
(Finback and Rorquals)



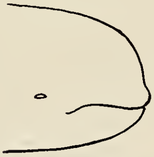
9. BACK WITH A HUMP
(White Whales and
other species)



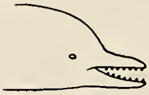
10. BACK WITH A FIN
(Certain Porpoises
and some whales)



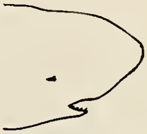
11. BACK SMOOTH
(Right Whales)



12. HEAD ROUNDED
(White Whale, Grampus
and others)



13. HEAD WITH A BEAK
(Dolphins and others)



14. HEAD POINTED
(Pigmy Sperm Whales)

LETTERS

Continued from page 193

The two porpoise-like creatures, much larger than porpoises, snow white, and seen half a mile off the coast of Brittany can have been none other than the Bottlenose Whale. This is the only white cetacean with a dorsal fin occurring in the North Atlantic, and the only white whale of any kind that would normally frequent this latitude.

During the summer this whale travels as far north as Greenland and in winter migrates south at least to the Mediterranean. Full-grown specimens range from 20 to 30 feet in length, but the tendency is to underestimate their size at a distance. The front of the head in a male Bottlenose rises abruptly from a rather short beak, housing a storage tank containing clear pure oil of the finest lubricating quality. Strangely enough, the color of this whale changes with age—much like that of the Beluga or White Whale. In infancy, they are grayish-black, but as they mature, yellow-white patches appear. Confluence of these patches in adult females produces a yellowish marbled effect; some old males are pure white or yellowish white. It is claimed that when harpooned, a Bottlenose Whale may stay under water for two hours and that a herd will never leave a wounded comrade. However, as soon as the whale is dead the herd moves on.

The third specimen seen below the cliff must have been a Risso's Dolphin, often confused in literature with the Grampus. The Grampus, a killer whale, is the dread tiger of the seas and does not hesitate to gang up and murderously tear apart great Baleen Whales. Risso's Dolphin, a moderately large species, about thirteen feet in length, has a high slender dorsal fin, a rounded face, and high forehead. The general color is gray but the shade is extremely variable and often mottled, head and shoulders becoming more or less white with maturity. This dolphin is widely distributed in the temperate and warm waters of the Atlantic. Usually solitary, they occasionally travel in pairs. The famous "Pelorus Jack" of New Zealand was a Risso's Dolphin. He accompanied vessels entering Pelorus Sound for about 32 years, and his popularity won for him protection for the period of his natural life by order of the New Zealand Council.

◀ These sketches illustrate the most useful fea
for distinguishing the various whales, porp
dolphins, etc. They are numbered according
standard system. This is so that if one of
animals is found stranded on a beach, its chara
istics can conveniently be dispatched by lette
wire to the U. S. Coast Guard or to any of the l
biological institutions interested in such ma
The identification can then be made, and the an
can be disposed of or receive scientific atten

For example, if the animal has whalebone i
mouth (1), it must be a Baleen whale. If it ha
pointed head shown in number 14, it is a pi
sperm whale. But generally a combination of
or more features is necessary for specific ident
tion, because 37 recognized species are include
this assemblage of animals. Size and color are
able additional clues.

The sketches will prove useful to one obse
marine life from the deck of a steamer, and
point the way toward definite identification,
cially if used in conjunction with a handbook
scribing the various species in more detail.

The example of Risso's Dolphin on exhibit at the American Museum was prepared under my supervision from an illustration by Sir William Flower of a freshly-caught specimen. The numerous white streaks on this animal were battle scars inflicted by the tentacles of the giant squid and octopus, favorite food of this dolphin.

* * *

Sirs:

Your issue of Natural History with the article by the Muenches on the Yuccas interested me greatly. The pictures were especially fine. I have often wondered how the Joshua Tree got its name. Perhaps someone at the Museum could give me this information.

(Mrs.) Elizabeth C. Smith.
Kennett Square, Penna.

The following explanation is given in C. J. Hylander's *The World of Plant Life* (The Macmillan Company, New York 1939), page 564: "Our Southwest is the home of many strange and curious plants, none more grotesque than the species of *Yucca* known as Joshua Tree, which frequently reaches a height of thirty or forty feet. The woody trunk branches to form an irregular head, the terminal branches being bent and twisted in various directions and covered with an armor of short stiff narrow leaves. The name is said to have been given these trees by the Mormons when they were crossing the California deserts on their way to Utah, the bizarre branches seeming to the wanderers to look like the outstretched arms of a Joshua leading them on their way out of the wilderness. . . ."—Ed.

* * *

Sirs:

I thought you might be interested in the way Natural History works here. First we read it, then I pass it on to the neighbor boy. He is a freshman in Springfield High. After he reads it, he passes it on to what he calls his boys. He is in charge of a Cub group. When they have seen it, it goes out to the Springfield High for the Library. . . .

I have enjoyed the magazine for some years and hope to continue.

Frank Morris.
Springfield, Oregon

Sirs:

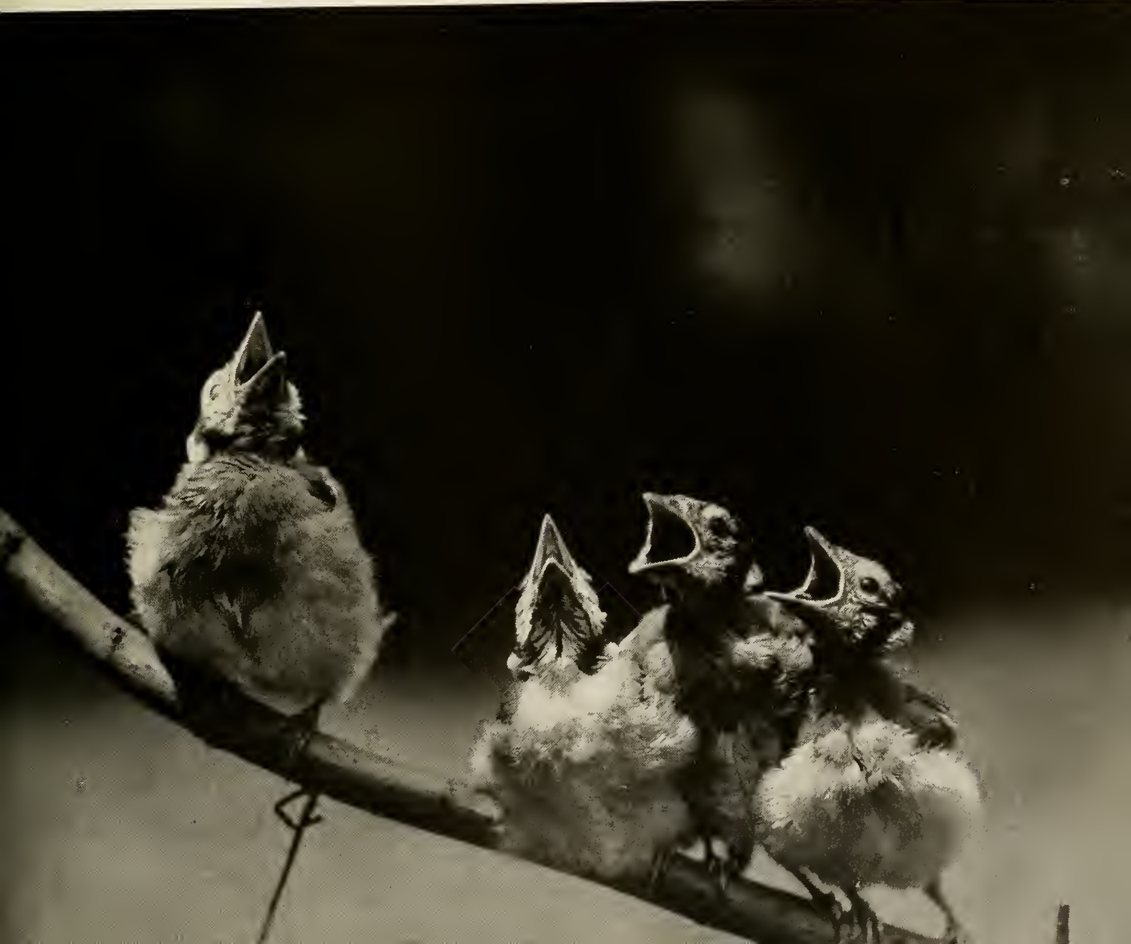
I am very pleased to have this opportunity to contribute in some small measure to the educational program of the Museum. I regret that such a possibility was not brought to my attention before. From my own vivid recollections of the profitable and wonderful hours of boyhood spent in the awesome halls of the Museum, I know that the pleasure and instruction which the institution affords cannot be measured in dollars and cents. Surely, there are many others who would welcome an opportunity to assist in your worthwhile work. Kenneth J. Moser.

Paterson, New Jersey

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

Blue Jays at mealtime: an unusual photograph by W. Bryant Tyrrell of Takoma Park, Maryland. Their parents had been killed, and the young birds were fed by hand.

From Frederic Lewis



SIRS:

. . . Some months ago there was an article in your magazine telling about the disease that was killing the saguaro cactus in Arizona. Would you tell me what success the government has had in combating this?

ETHEL M. BASS.
Los Angeles, Calif.

An article giving further information on this subject is now in preparation and will appear shortly—ED.

* * *

SIRS:

I was much interested in the "Toad" story by Roy L. Abbott in the March issue of NATURAL HISTORY. One feature of the toad's action, which I have experienced, was not mentioned. That is the singing, which can be heard if one holds the toad in one hand and gently strokes its sides with the other.

I have noticed that not all toads react. Does this mean that the male will sing and the female will not?

Any information on this point will be appreciated.

J. W. HOLLISTER.
Schenectady, New York

The following answer is given by Charles M. Bogert of the American Museum's Department of Amphibians and Reptiles:

There is indeed an answer to Mr. Hollister's question concerning toads. In fact, Dr. Lester Aronson in American Museum Novitates No. 1250, published in 1944, has a rather lengthy one. It has been known for some time that female toads, probably of all species, are mute in contrast to the males. Dr. Aronson recognizes three distinct calls in males of the American toad, and in Fowler's toad, the two common species in northeastern United States. First, Aronson points out, there is the sex call or trill uttered by males which congregate in suitable ponds during the breeding season. To some extent at least, this call attracts females as well as males of the same species to the breeding site.

The second call distinguished by Aronson he calls a "chirp," and the male toad utters it when touched on the back. It is very nearly of the same pitch as the trill, but it is of much shorter duration although it may be repeated continuously if the toad is stroked as Mr. Hollister describes. Why the toad makes this noise under such circumstances is not clear; no obvious purpose is served, and of course it may not have any, much as naturalists like to interpret behavior in such terms.

Aronson ascribes a function to the third call that he was able to recognize, and he calls this "the male warning vibration." This is a dull, vibratory note that is barely audible unless the toad is held within a few inches of one's ear. Like the chirp, it can be elicited by stimulating the back of the male toad, and under natural conditions the warning vibration plays an important role in sex recognition. After toads have assembled at the breeding site in some numbers, there is a certain amount of confusion. Perhaps you will recall a cartoon that appeared in the *New Yorker* Magazine which showed two turtles, and one of them saying "I'm a girl." Rather succinctly this poses the problem that confronts both amphibians and reptiles during the breeding season. At a distance a toad cannot distinguish the "boys" from the "girls." Unlike the unabashed turtle in the cartoon, the voiceless female toad cannot proclaim her sex. However, if a male attempts to clasp another male toad, the latter responds with the warning note and the vibrations are transmitted through the body to the limbs of the misguided male, which thereupon ceases his attentions and continues his search for a toad of the opposite sex.

So Mr. Hollister's observations are correct, and his inference can be verified—the females do not sing, but the males do, with a trill, a chirp, or a warning vibration, to suit the occasion.

MUSEUM COLLECTIONS TO BENEFIT MEDICAL SCIENCE

Plans for an Institute of Human Morphology in the American Museum of Natural History, which will make extensive skeletal archives available to students of all sciences concerned with the structure and form of the human skeleton, has been announced by Dr. Harry L. Shapiro, Chairman of the Museum's Department of Anthropology.

The first stage in the organization of the new project is made possible by a special grant from the Viking Fund. Dr. Erwin H. Ackerknecht, former research fellow at the Institute of the History of Medicine, Johns Hopkins University, and recently appointed Assistant Curator of Physical Anthropology in the Museum, will be in charge of the Institute of Human Morphology under the direction of Dr. Shapiro.

In speaking of the purpose of the institute and its work, Dr. Shapiro remarked:

"Although New York City is the greatest medical center in the world, comprehensive collections for the study of variations in the human skeleton have never before been made available to students and professional people. The American Museum of Natural History hopes to fill this need by establishing such a collection, which would be accessible to doctors, dentists, physical anthropologists, and general biologists who seek material pertaining to their specialties.

"The need for large, fully classified skeletal data is evident from recent requests from research projects concerned with the obstetrical study of the female pelvis, with the orthopedic investigation of malformations of the spine, and with evidences of dental erosion. We hope to make these archives of increasing benefit to medical and biological research."

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NATURAL HISTORY

June 1945

VOLUME LIV No. 6 FIFTY CENT

handicrafts

It certainly isn't new—this fascination of making things yourself—, but with the current curb on activities such as dashing off somewhere in a car or taking a long scenic trip by rail or boat, the urge to create has become more prevalent. If we all became perfect, the manufacturer would go out of business, but we may, with the aid of basic principles, create things with a personal touch that will have their own value. We now have, in the Book Shop, a section on Handicrafts, which is becoming very popular. Perhaps some of the books listed below may inspire you.

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LETTERS

SIRS:

Having done field work for about six years in and around Death Valley in connection with research on living and fossil fishes, my attention was naturally drawn to the fine article by Rufus Mather Bagg on Death Valley in the April issue of NATURAL HISTORY. The excellent photographs brought back clearly memories of many trips in and out of the "Valley of Death."

I observed your footnote regarding fish life and had read William V. Ward's article on Death Valley fish. In addition to the well-known population at Saratoga Springs, there is a far more striking fish inhabiting the briny waters of Salt Creek, in the very heart of Death Valley, 180 to 250 feet below sea level. Both species belong to the genus *Cyprinodon,* which comprises a group of small, brightly colored, tenacious fishes inhabiting the fresh, salt, brackish and mineralized waters from the United States, Mexico, and the West Indies to South America.

Cyprinodon salinus, the species confined to Salt Creek, reaches a length of nearly three inches. The males are deep blue, with spangles of purplish iridescence reflecting from the scales along the back, and they have a black band on the tail fin during spawning time. Females are more somber, generally brownish, with irregular vertical bars and a black blotch near the base of the dorsal fin. In midsummer, these fish have been found in water as warm as 100° F.

During Late Pleistocene time, when the great ice sheets were retreating in North America, a vast body of water named Lake Manly covered the floor of Death Valley to a depth of about 600 feet. This was roughly 20,000 or more years ago. At that time, it is assumed that *Cyprinodon salinus* and *Cyprinodon nevadensis* (the species now found in Saratoga Springs) were represented by a common ancestor, and the evolution of each dates from the desiccation of Lake Manly.

Before the advent of the white man, and until recent generations, the Panamint Indians utilized the Salt Creek fish for food, gathering them in large porous baskets, aided by "tule" brooms, during springtime when this species swarms in the creek. The fish were baked between layers of tule reeds alternating with layers of hot ashs.

The old desert prospectors tell fantastic tales of immense underground rivers that populate the springs with blind fish, but although such mythical stories add to the lore of the region, the fish are not blind and their present distribution in this arid waste dates from the Pleistocene.

ROBERT R. MILLER,
Associate Curator of Fishes,
Smithsonian Institution.
United States National Museum,
Washington, D. C.

IMPORTANT NOTICE

Readers are reminded that NATURAL HISTORY is not published during July and August. Those who expect to be away after September 1, however, and wish to have their September issue sent to a temporary summer address are requested to notify the Membership Secretary. Please give the date of expected return to permanent address.

NOTICE—Readers are encouraged to submit their photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

As an example of the unusual exploratory experiences in which our Army fliers sometimes engage, Miss Caroline Mytinger, the well-known artist, who herself has done exploring in the Solomon Islands and elsewhere, gives us the following letter from New Guinea:

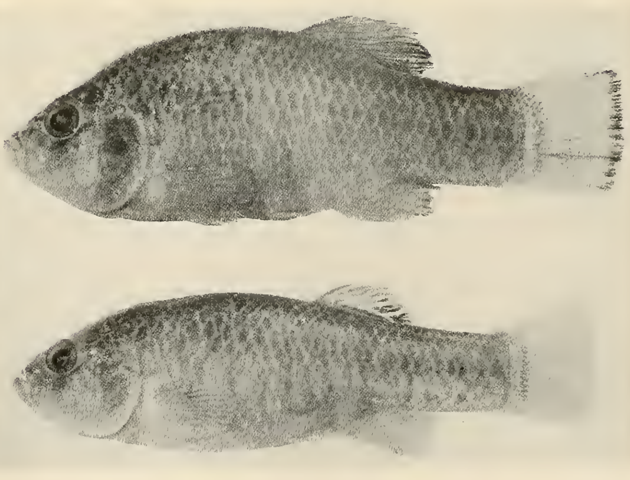
DEAR MISS MYTINGER:

. . . Your remarks about the pygmies up in these mountains bring to mind something that may be of interest to you. A while back I was called down to operations. They had asked for a pilot with experience in flying over jungle territory and, as I was the only one available at the moment, I was sent down. It seemed there were some survivors of a Dutch peacetime garrison living up in the hills with the natives, who were to be brought down for information as well as safety. The garrison had escaped from Manokwari two years ago. They pushed their way into the hills to the southwest, and after a terrible journey the party, including women and children, was found by some natives, who were now taking care of them. One of the natives had been persuaded to make the long trip down to the coast to contact the Dutch, which he managed to do after being gone for about three months.

Rescue parties were organized immediately but they were all doomed to failure because of the impossible ground that had to be traversed. Finally C-47's were sent up and managed to drop food and medicine and a radio set, and—to make a long story short—the natives were asked to build a landing strip. My orders were to measure the field and find out if it were suitable for the big cargo ships to land there and pick up the Dutch women and children. I was given all the available information and provided with a native scout who knew the lay of the land although he had never been up that far, and we checked out in a small L-5 (Stinson Valiant to you).

The most exact information I had was that I would find the strip somewhere toward the southern end of the Kebar Plains, but as you know, no two charts of this country are the same. Three charts I looked at showed the Plains in three different locations. Later, checking over the fuel consumption and time, I figured the

Continued on page 292



MALE (*above*) and female (*below*) of a fish that survives from the Ice Age in the heart of Death Valley: *Cyprinodon salinus.* The fish inhabits the briny waters of Salt Creek, 180 to 250 feet below sea level

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The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President
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VOLUME LIV—No. 6 ★ ★ ★ ★ JUNE, 1945

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From a Kodachrome by Cleveland Grant

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You will find Natural History Magazine indexed in *Readers' Guide to Periodical Literature* in your library

THE COVER THIS MONTH

(*Reproduced from a Kodachrome by Cleveland Grant*)

THE BLUEBIRD

The Bluebird, with the sky on its back and the earth on its breast, is one of the most beloved of our American birds. When early signs of awakening spring appear in the woods and fields, we listen for its soft warble as assurance that winter is departing.

Everything about the Bluebird is attractive. It is graceful, its coloring bright but not gaudy, its voice musical and gentle, and it likes association with man. The hollow limb of an old apple tree makes a favored site for its nest, but it is willing to accept a nesting box near man's own dwelling, especially when natural quarters are scarce in well-kept orchard and woodland. In the interior of the hollow is placed a nest of grasses and soft fibres in which three to six pale blue eggs are laid.

When autumn comes, the Bluebirds leave their more northern homes and travel southward, but even as far north as southern New York, some remain all winter. Gathered into flocks, with their bright colors half-concealed under grayish tips on the feathers, they have an unfamiliar appearance against the snow-covered landscape. When spring comes, the feather-tips are worn away, the flocks break up, and the Bluebird again seeks the dooryard to tell in its soft voice that "sumer is i-cumen in."

John T. Zimmer.

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YOUR NEW BOOKS

GARDENING • HAWAIIAN FISHES • GEOLOGY
THE LONG JOURNEY • SCIENCE IN PROGRESS

PRINCIPLES OF PHYSICAL GEOLOGY

- - - - - - - - - by Arthur Holmes

Ronald Press Company, $4.00
532 pages, 262 figures

POPULAR writers on scientific subjects often excuse their efforts by saying that someone must explain technical subjects in simple terms for beginners, and that if the scientists are unwilling to do so, less well qualified authors must. And often the author who is more gifted in writing than research can do a better job of simplification than the scientists endeavoring to explain his specialty to the layman. Occasionally we find the fortunate combination of an author who is a genuine authority as well as a capable simplifier, and from these people stem our best general works. Arthur Holmes is one of England's best known geologists, and he stands high in his field. His latest book is obviously intended as a textbook for an elementary course in geology, but it is so comprehensive and readable that the general reader would not consider it too dry for his attention.

The subject matter of any geological text, is, of necessity, always the same, though the approach may vary. Here we find first a discussion of the materials and nature of the earth, followed by an account of the shaping processes on the surface; the running water, winds, and ice. This is followed by a description of the internal processes, as deduced from the observed effects in ancient rocks and in the living geology of volcanoes and earthquakes.

The book is well illustrated. Many of the pictures show American formations, with which readers in this country will be familiar, while others show some of the classic features of England and Europe, less well known to Americans. To some this may seem a drawback, but it is desirable for us to realize that we have no monopoly on remarkable manifestations of geological processes. Dr. Holmes is to be especially commended for two features of this book: first the bibliographies for further reading, which are placed at the close of each chapter—and second, for his open-minded attitude toward admittedly unproven and perhaps unprovable theories, which we find in the speculative part of the book. An admission of ignorance regarding the many things still to be learned about our earth is probably the most stimulating thing that a beginner can read, for he knows that he has a long and fascinating road to travel and need never fear that it will end before his vehicle runs out of gas.

F. H. POUGH.

HAWAIIAN FISHES

(A Handbook of the Fishes found Among the Islands of the Central Pacific Ocean.)

- - - - - - by Spencer Wilkie Tinker

(Illustrated by Gordon S. C. Chun and Y. Oda.)
Tongg Publishing Co., Honolulu, $3.50
404 pages, 8 color plates

THE purpose of this book is to help persons without special knowledge or recourse to technical terms to identify Hawaiian fishes. For this it relies largely on profuse illustrations. There are eight plates showing 85 different fishes in color, each of course small, but in general pleasing and satisfactory, besides black-and-white text figures, varying in excellence, of some 500 different fishes. The book is of a convenenient small size, attractively made, and very timely.

There has recently been a continuous demand for something of this nature from the many Americans now scattered over the tropical Pacific. Since some of the common characteristic fishes range all the way from the Hawaiian Islands to the Red Sea, and other East Indian species are obviously closely related to their Hawaiian representatives, it will be helpful over the breadth of the ocean.

Where several similar and closely related fishes are concerned, it may not be possible to differentiate them with a book of this kind. It also has certain weaknesses of the sort that can occur in a compilation from diverse sources. For instance, of the two common market "uluas," the name *Caranx melampygus* has formerly been used for one which is here figured twice, as *C. melampygus* and *C. stellatus,* and the other, for which *C. melampygus* is now current, is confused with a different fish. There are other errors, similarly caused, which prevent exact determination of a few species.

Whatever its shortcomings, *Hawaiian Fishes* is evidently the product of considerable serious work. It should be a boon to persons interested in Pacific fishes yet having no great knowledge of them, and it should prove a helpful stepping stone to a more ichthyologically authoritative treatment of the subject in the future.

J. T. N.

NATURE ENCYCLOPEDIA
Edited by G. Clyde Fisher; five volumes bound in De Luxe Green Keratol lettered in Gilt, pages are 5⅜ x 8 inches. Lives and habits of Birds, Mammals, Fish, Reptiles, Flowers and Trees; described by renowned Naturalists; 700 illustrations, 200 in Natural color. The Literary Mart, 8 East 33rd St., New York 16, offers this set for $7.50, remittance with order, returnable for full refund within five days.

PERENNIALS PREFERRED

- - - - by Helen Van Pelt Wilson

M. Barrows & Co., Inc., $2.75
256 pages, 26 illustrations

THIS well-planned book starts the gardener with the fundamentals of flower culture, such as the nature of soils, the value of compost, the use of fertilizers, and methods of propagation, and then, with the understanding of basic principles thus gained, guides him through the seasons with helpful advice on what to plant, how to arrange it, and the care to give in order to secure the best results. All of this information will be useful to anyone who grows flowers but especially to those meticulous and conscientious souls who can plan an orderly garden and then stick to it through the ravages of insects, invasions of grass and weeds, and the capriciousness of climate long enough to see the wishful thinking materialize.

The author has a practical and humorous treatment of her subject. She recommends a species, for example, and while its merits are sung the reader is also cautioned that in his particular yard the plant may not grow as enthusiastically as it does on the pages of a seed catalogue. "In most cases if plants cannot thrive under the average conditions I offer, we simply part." This can well serve as a guiding principle for most flower growers, and the author's rich experience, as conveyed through the pages of this book, will assist one in making the selection of what to grow on his own premises.

The portfolio of perennial plants and their arrangements in the garden and in the house should convince anyone of the soundness of the author's ideas. The halftone illustrations are well executed and the results are stimulating. The charts, tables, and plans show careful preparation.

And, finally, the clever sketches with humorous captions are worth mention. "Never let your husband play with the hose in the evening" is an excellent idea. It might even be extended to forbid him to play with the lawn mower. I am all for it.

H. E. Anthony.

THE LONG JOURNEY

- - - - - - - by Johannes V. Jensen

Alfred A. Knopf, $3.50
677 pages

THIS innocently small-looking volume is the Nobel Prize edition of a well-known work, first published in Denmark and shortly after in translation in this country, all of 20 years ago. Awarded the 1944 prize "for Literature," the performance has claim to notice here only because it is actually a brief fictionized version of the fundamental biologic and cultural aspects of human history.

The author has long been recognized as a prolific and versatile literary artist; but he is directly known to the reviewer only as a cosmopolite who has read much and traveled widely. Thus gifted and armed with a vast range of facts about nature and the life of man, past and present, he has here written with undeniable power but at the same time rather lengthily and solemnly and therefore, in one sense, probably less successfully than our own Jack London and Hendrik Van Loon.

The Long Journey is a poetically conceived prose-epic of human progress ranging from preglacial and prehuman times up to the discovery of America by Columbus. Each of its originally six or seven separate books describes the human scene at some particular stage of cultural development, and the drama—in conformity with the Carlyleian concept of progress—is supplied chiefly by the inventive activities of the contemporary guiding genius and by his struggles with the normally conservative group. Thus in the first book the culture hero, in spite of protests, introduces the use of fire and invents the first simple implements. In the second he devises, among other things, a method of producing fire. And in the third he appears as boat-builder, navigator, and explorer—the forerunner, as it were, of Columbus. Near this point the tale rises to the historic and biographic level and so passes beyond the immediate interest of prehistorians.

Pointed criticism is here impossible. Besides, a work of art is primarily an adventure in esthetics, rather than in logic or science—in short, is an appeal to the heart as well as to the head. Naturally, therefore, in such a work as this the scientifically-minded and the poetically-minded are bound to find points of disagreement, whether justifiable or not. Consequently, the reader had better judge for himself. Indeed, for those who believe in a living, eternally becoming world, and especially for those who are interested in the origin and destiny of man, no more illuminating or trustworthy book of fiction has been written.

N. C. Nelson.

PINE, STREAM AND PRAIRIE

- - - - - - - - - - - by James Gray

Alfred A. Knopf, $3.50
312 pages, 34 illustrations

"IT is an old habit with people of Wisconsin and Minnesota," Mr. Gray says, "to vibrate between the civilized world and the world of the wilderness," and that is exactly what his book does. It is not merely a static collection of facts, as many regional volumes have been of late; here is a vibrating, living knowledge of a country, which, moving from its past through the present into its great future, shows it clearly and sympathetically in all three stages.

The range of subject is wide—the land itself; its people, from great financier to jack-pine savage; ways of life in forest and farm and mill; types of culture; the arts; recreation and social life. But these myriad facts are not simply stated,—they are interpreted with sound judgment. Here is stimulating analysis as well as authentic information, amusing anecdotes, and keen wit. In a description of the University of Wisconsin's theatre, Mr. Gray says lightheartedly, "It is the very model of a modern auditorium." And after a penetrating evaluation of Frank Lloyd Wright's contribution to architecture he adds pensively, "He has a great deal to say about doom. . . . At breakfast doom is presented as cheerfully and casually as though it were a hot buttered roll." His characterizations throughout the book are a delight.

One striking aspect is the weighing of imponderables as well as the material values. "Nothing defines the character of a time or place quite so clearly as the quality of its abstract thinking," Mr. Gray says. So he describes six creative and independent minds in Minnesota and Wisconsin and their contributions to the world of thought.

To me the most beautiful and satisfying chapter is the one called "Short Retirement, Sweet Return," describing the wilderness region along the border between Minnesota and Canada, where the world is still "what it has been since the beginning of the time when earth began to sustain life." Not in this chapter, for it is idyllic, but somewhere in the book, I

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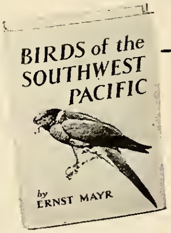
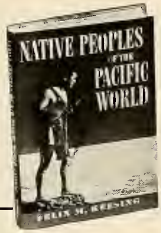


BIRDS of the SOUTHWEST PACIFIC
by Ernst Mayr, American Museum of Natural History
This practical handbook is the first in English on the birds found on the main islands of this rich and remarkable area. Identification keys are simply and clearly worked out for the beginner. There are 3 color plates illustrating 39 birds by F. L. Jaques; 15 line drawings by A. Seidel. Published. $3.75

MAMMALS of the PACIFIC WORLD
by T. D. Carter, J. E. Hill, G. H. H. Tate
American Museum of Natural History
Here is disclosed the origin, life history, and distribution of an astounding array of mammals found on the islands of the Pacific and the East Indies. Some of the mammals described are unique and are found only on these islands. A geographical index is included. $3.00

MAMMALS of the PACIFIC WORLD



NATIVE PEOPLES of the PACIFIC WORLD
by Felix M. Keesing, Professor of Anthropology, Stanford University
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The Macmillan Co., New York 11

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wish that Mr. Gray had told of the heroic fight the Quetico-Superior Council is waging to preserve this priceless wilderness from exploitation. This dramatic story is only given one sentence, "The Quetico-Superior Council has fought off those who wish to exploit the last wilderness," and this is disappointing. But perhaps sometime Mr. Gray will write a book on that saga.

FLORENCE PAGE JAQUES.

HAYFEVER PLANTS

- - by Roger P. Wodehouse, Ph.D.

The Chronica Botanica Co., Waltham, Mass.; G. E. Stechert and Co., New York City, $4.75
245 pages, 73 figures

READERS of NATURAL HISTORY will recall the excellent article by Dr. Wodehouse in the March, 1939 number, entitled "Weeds, Waste and Hayfever." That popular article was copiously illustrated by photographs and graphic distribution charts covering the map of the United States. The book now considered may be looked upon as an elaboration of the same subject matter. The author says that it is intended to interpret the botanical facts of hayfever in terms of their clinical significance. Here, he says, are described all of the plants known to cause hayfever, most of those reasonably suspected of doing so, and many which have been mentioned in hayfever literature, possibly wrongly.

Dr. Wodehouse, who is Associate Director of Research in Allergy, Lederle Laboratories, Pearl River, New York, has given us a carefully prepared book on the subject that will be a great satisfaction to botanists and physicians as well as the layman.

CLYDE FISHER.

SCIENCE IN PROGRESS

- - - Edited by George A. Baitsell

Yale University Press, $3.00
331 pages, 106 figures

THIS volume constitutes the fourth in a series oriented toward the wider publicization of the scientific research currently in progress in various laboratories throughout the nation. Each of the eleven contributors ranks high as an investigator in his own field, and each of the separate chapters is an authoritative and up-to-date treatment of one particular area of the broad region of the natural sciences.

Some of the topics covered are indicated by chapter headings such as, "Psychological Aspects of Military Aviation," "The Physical Structure and Biological Action of Nerve Cells," "The Magnetic Approach to the Absolute Zero of Temperature," "Streams of Atoms," "Adventures in Vacuum Chemistry," and "Present Status of the Vitamin B Complex."

Although the subjects are highly technical in nature, the general treatment is admirably suited to the vocabulary and general background of the intelligent reader whose academic training has included only the barest essentials of natural science.

So varied are the topics, and so diverse the methods of treatment that an adequate evaluation of separate chapters is impossible in a brief review. Suffice it to say that the book is interesting, informative, and well worth the serious attention of every reader who wishes to keep pace with the rapid advance of scientific knowledge which seems certain to play an ever increasing role in the daily life of the average citizen.

F. A. B.

ANNUAL FLOWERS FROM SEED PACKET TO BOUQUET

- - - - - - - by Dorothy H. Jenkins

M. Barrows & Co., Inc., $2.75
223 pages, 16 plates

AMID the scores of books written on gardening, this volume seems to the reviewer a strikingly fresh presentation of a necessarily somewhat repetitious subject. With the best will in the world an author is virtually compelled to fork over such good old headings as soil preparation, damping off, the way to make liquid manure, how to prevent cut worms from cutting choice young seedlings and plant lice from giving hypodermics to the sweet peas, but this author has interpolated all such counsel with skill and almost painlessly. A few pages farther on a feeling of awe and perhaps a suspicion of disbelief is occasioned by the passage "I believe in hoeing the entire garden once a week until Labor Day."

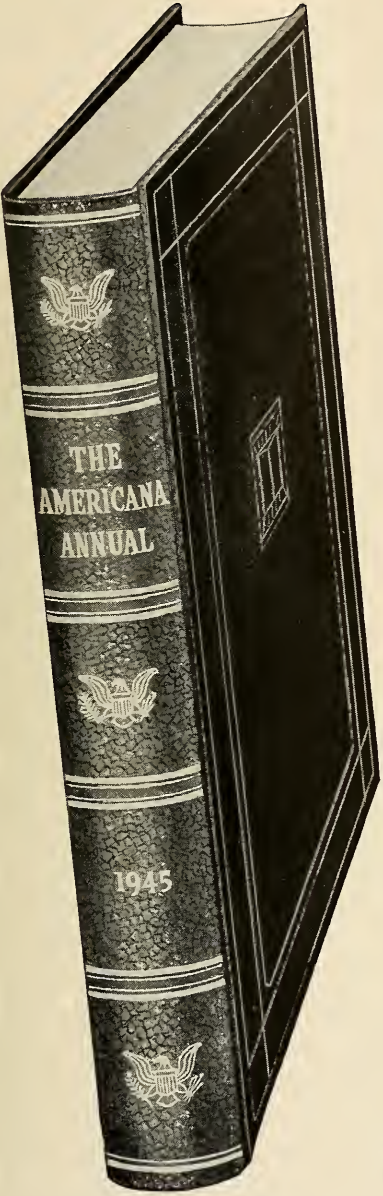
The book seems particularly apropos to this reviewer, because he contemplates planting an extensive plot of annuals this year. From experience gained in other seasons he can endorse the truth of Miss Jenkins' assertion that no actual garden ever approaches the perfection of the dream-garden conjured up during January evenings by the study of seed catalogues.

Seriously, however, the book will be a boon for growers of annuals. Every contingency seems to have been covered. Following the opening eight chapters on growing annuals in general, come a set of articles dealing with specific kinds, such as the Marigolds, the Petunias, the Zinnias, and the Asters. Advice is then given on the use of vines and edging plants, on the cutting of flowers, and on new varieties.

The third part of the book is devoted to uses of annuals for adornment,—making corsages and boutonnieres, dressing window-boxes, and decorating churches. This is followed by a calendar of garden chores, a checklist by colors of flowers, and another based on their utility, also a glossary, and an index. Whoever follows all the admonitions set forth in this volume will assuredly carry off the first prize at his local garden club.

The book is tastefully illustrated with a Kodachrome frontispiece and a block of half tones by Gottscho-Schleisner, as well as delicate little sketches by George L. Hollrock, which have unfortunately suffered rather sadly in reproduction.

G. H. H. TATE.



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NORMA—the average American girl

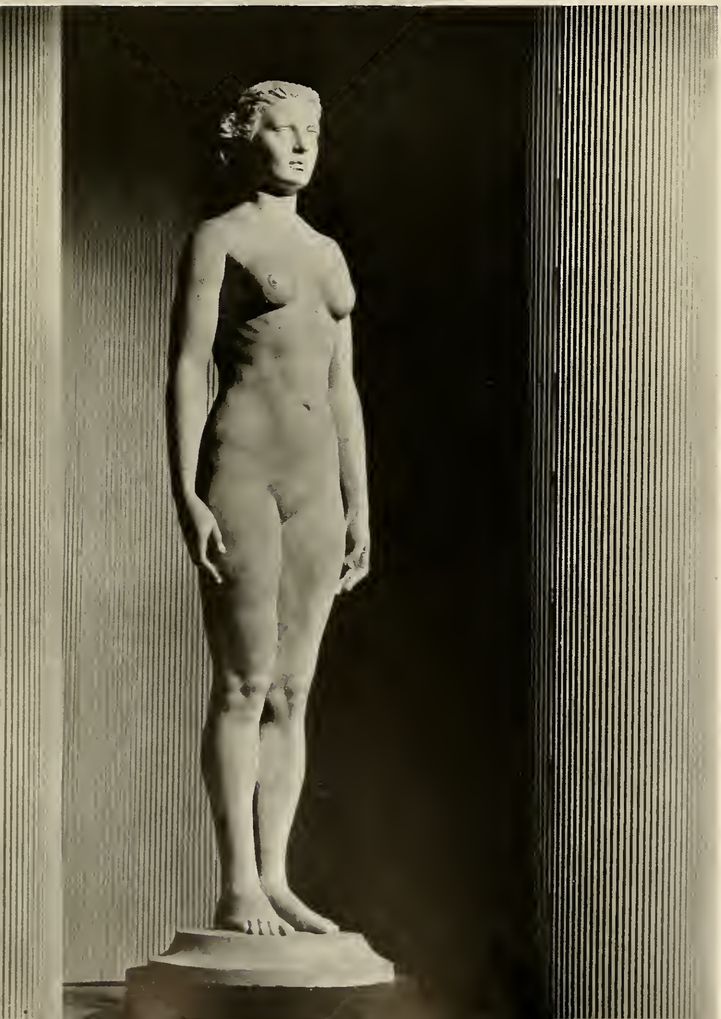
SHE IS MODELED from recent measurements of 15,000 women from many parts of the United States and from various walks of life, including series of college students and other thousands of native white Americans. She is slightly heavier yet more "athletic" than her grandmother of 1890 and has lost the shrunken waist induced by tight corsets. As to the beauty of her figure, tastes will vary; fashions change ideals from one generation to the next. Norma is not meant to show what ought to be; she shows what is.

Dr. Robert Latou Dickinson, who drafted the proportions and posture of the figure, has devoted six years with Abram Belskie to the planning and finishing of anatomical, obstetric, and surgical models which might be widely distributed for teaching purposes. In this work, at the New York Academy of Medicine, he has consulted the great anthropologists in person and tapped all the statistics to ensure accuracy in all details. He shows in Norma the average American girl of our day, 18 years of age.

The sculpture has been done by Abram Belskie, member of the National Sculpture Society.

The statue, like that of Norma's "brother" on page 252, is reproduced for the first time in NATURAL HISTORY Magazine through the courtesy of the sculptors and the Cleveland Health Museum, which will take over production of the series.

A.M.N.H. Photo



A Port

Scientific studies reveal that w have changed considerably sinc the days of our forefathers. Th typical American is certainl quite different from what othe nations have predicted for us, also perhaps different from wha we ourselves have imagined

Most Americans, in conversation with representatives of other nationalities, have probably found themselves discussing what it is that distinguishes the people of the United States and as frequently, no doubt, attempting to define the character of the other nationalities in such a mixed company. In this world of self-conscious nationalism, almost every country has acquired a personality and a type—often enough, a kind of Janus or split personality, one face as the country sees itself and the other as seen by its neighbors.

The British, collectively, in their national self-portraiture, are inclined to emphasize quite naturally the traits they regard as lovable, worthy, gentlemanly, or noble. Their native spokesmen describe them as reserved, sensitive, poetic, devoted to fair-play, fond of sport, inclined to "muddle through," and eminently law-abiding. Foreign and less generous observers are more likely to dwell on their pig-headedness, their snobbishness, their perfidy, and various other less agreeable human traits.

The French, too, take pride in their catalogue of national virtues, which they sometimes imply are uniquely theirs, such as their logic, their intelligence, their thrift, their capacity for passion; while in the hands of their critics, their thrift becomes parsimony and their passion a form of immorality and lack of restraint.

We Americans, also, have a fa-

ait of the American People

By HARRY L. SHAPIRO

Chairman, Curator of Physical Anthropology,
American Museum of Natural History

vorite chromo of ourselves that we like to hang in the family parlor. We picture ourselves as idealistic, honest to the point of being easy marks for our devious neighbors, generous, hospitable, friendly, inventive, efficient, competitive, and progressive. Many Europeans look darkly at this picture and take on their own account a few candid camera shots that are as flattering as passport photographs, revealing us as dollar-chasing Shylocks; insensitive to culture, meddlesome, flippant, boastful, and preaching; gangsters who are ridden by a mania for speed, gadgets, and law-breaking.

Although these characterizations are stereotypes, which at their best are merely acute generalizations and at their worst malicious and inaccurate, they are symptomatic of the trends of national differentiation that arise from differences in history, environment, and culture. Even if we cannot measure it objectively, the reality of national patterns of character structure is patent enough from experience.

An American, even of the purest English descent, who reverses the trail of his ancestors and hopefully transplants himself in England, is likely to encounter some difficulties in recrossing the line that now divides an Englishman from an American. The experience of some of our most celebrated expatriates illustrates how American Americans have become. Henry James, for all his love of the English and their ways and for all his efforts, never succeeded in passing as an Englishman among Englishmen, although it must be admitted that he sometimes fooled Americans. Sargent and Whistler, utterly different as they were in so many things, always remained Americans as far as the English were concerned, except when they were claimed as ornaments of British painting. Sir Osbert Sitwell recalls that

One American Ideal

ONE IDEAL in the feminine figure is represented by Rosemary Sankey, chosen to epitomize the "high fashion girls" of John Robert Powers. These models, constituting a very uniform physical type, are significant because they are eagerly sought after as dress models and are obviously much admired by the public. In this group, bust, waist, and hip measurements of 34-24-34 are considered close to the ideal. The greatly increased height, the notably wide shoulders and the slender hips of the "high fashion girl" combine to differentiate her from Norma; but these same characteristics may also be regarded as the extreme of a tendency that has been noted to a lesser degree in the average American girl in recent generations.

Miss Sankey herself shows a figure that is further in this direction even than the average "high fashion girl." Her measurements are: shoulder width, 14.9 inches; bust, 33½ inches; waist, 23 inches; and hip width 11¼ inches. She is 5 feet 7 inches tall and weighs 117 pounds.

Photograph by Don Selchow.

when his father commissioned Sargent to paint a conversation piece of the Sitwell family, Lady Londesborough, the maternal grandmother, distinctly disapproved of the choice of Sargent on the grounds that he was an American. I should perhaps add that Sitwell, père, did his best to find an English painter and only settled on Sargent after discarding several English candidates as inadequate.

Personalities, however, although they seem to persist like the smile of the Cheshire cat long after the body has vanished into thin air, do enjoy ordinarily a physical embodiment. Certainly no picture of the American people as a whole can omit this vital component, which, unlike its abstract personality, is much more susceptible to exact description and objective measurement. The existence of a physical type, distinctively American, has for a long time been quite generally accepted both by Americans themselves as well as by foreigners. Indeed, regardless of any scientific support for such an opinion, one would have to be singularly impervious to suggestion to escape sharing it. Hollywood presents us with an inexhaustible parade of "typical American" beauties. Charles Dana Gibson delighted our mothers and our fathers with the apotheosis of the American girl of the 1900's. Lord & Taylor advertises "that American look" as the product of our native soil. And who is not familiar with the lineaments and aspect of Uncle Sam, our national portrait. If our artists, our impresarios, and our copy-writers had failed to convince us, our own observation could not. Americans, visiting Europe before the war, were easy to spot, not only by fellow Americans but also by natives and by those whose business flourished by virtue of their skill in this species of detection. No doubt clothes, manners, and speech contributed to make it relatively easy to distinguish an American from the indigenous population; but frequently enough, recognition was possible even without these adventitious aids.

I have been unable to determine precisely when Americans, or Europeans for that matter, first became aware that there was something that could be called an American physical type. Discussion of a generalized American character, it is true, appears well established by the middle of the eighteenth century. Franklin, for example, speculative as he was on many topics of general interest, held views on this, too. And even earlier one can find such colonial worthies as Colonel Byrd and the Mathers speaking of local manners and behavior as if they already recognized an American pattern, although not designating it in such broad terms. Certainly, by the end of the eighteenth century, interest in the American character, stimulated by the Revolution and the birth of a new nation, occupied the attention of almost every writer who ventured to discuss and describe the United States.

English visitors were particularly aware of our national personality; with few exceptions they found it unattractive and, of course, inferior to their own. Isaac Weld, Mrs. Trollope, Charles Dickens, and Captain Hall, among a host of other English travelers in the nineteenth century, standardized the excrescences of the portrait. In fact, one is somewhat amazed in reading this literature to reflect how analogous it is with the recent writing on Russia. The United States at the end of the eighteenth century and the early nineteenth represented to the Europe of that day a reprehensible and dangerously radical departure from political decorum. European and particularly English observers loved to dwell on the less attractive side of life in America. Democracy was not what it was cracked up to be. The democrats chewed tobacco; they entered into conversation without waiting the formality of an introduction. As servants they were forward and insisted on regarding themselves as good as their masters. Their offspring were independent and pushing. Democracy was noisy, aggressive, and lacked the refinements of traditional societies. Table manners were appalling and public conduct beyond words. Public and private conveniences, roads, carriages, trains, hotels—all were inferior to their European counterparts and uncomfortable.

Life, manners, and character altogether were so unsatisfactory that they seemed to take up all the attention, and little or nothing was left over for observation of the physical traits of Americans. When comments were made, they were apt to be disparaging. American girls had poorer color than the rosy-cheeked English girl. Americans had poor teeth, or the women were pretty enough as girls but faded quickly. But the American as an emerging subtype, neither English nor Dutch nor French but American, was slow in being recognized, or at least less obtrusive to foreign visitors than the facets of our national behavior. Crèvecoeur, however, a sympathetic French observer of American life in the latter half of the eighteenth century, commented enthusiastically on most aspects of it and with reference to Americans as a people wrote "here individuals of all nations are melted into a new race of men, whose labors and posterity will one day cause great changes in the world." This is one of the earliest references I have been able to find to the famous assimilation process that was to become widely known as the "melting pot."

Americans themselves, no less than Europeans, commented little, if at all, on the existence of an emergent physical divergence from their European forebears until the latter part of the eighteenth century when political events were beginning to weld a sense of nationality among the scattered colonies along the seaboard and to stimulate a feeling among Americans that they were a distinct people. Since exact evidence is lacking and contemporary observations are scanty, we cannot, in fact, be positive that there was in colonial times any obvious deviation among the colonials from the physical standards of their ancestors. Perhaps one of the reasons for this inattention sprang from the circumstance that for well over a century after the first settlements, the colonists were accustomed to think of themselves not as Americans but as Englishmen, Hollanders, Germans, or Frenchmen. They had come to the New World as Europeans, bringing with them not only the biological heritage but also the manners, customs, and ideas of their native lands. So conscious were they of their Old World origins and ties that even after a century of residence in the New World, they continued to call themselves Englishmen, Frenchmen, Swedes, or Hollanders. Their settlements were named New England, New Amsterdam, New Sweden, Nova Scotia, or, in loyalty to their sovereigns, Virginia, Carolina, Maryland, and Georgia. They fashioned their houses after models familiar in the countryside from which they came. They reproduced, as far as the new environment permitted, the life they knew in the old country; with such success in the Pennsylvania Dutch country that an eighteenth century traveler was amazed at the fidelity of the reproduction. Even after generation had succeeded generation, a native Virginian or New Englander of colonial times might still speak of "going home" when he merely meant a visit to England.

One of the earliest commentaries on the physical characteristics of Americans seems to have occurred in the latter part of the eighteenth century. The principals were our own Thomas Jefferson and the Abbé Raynal, a French popularizer and encyclopedist. Raynal, adapting Buffon's ideas on American fauna, had applied them specifically to the Europeans transplanted to the New World. The thesis was briefly this. Buffon, the grand panjandrum of French scientific circles, had come to the conclusion that American animals were smaller and inferior to their European equivalents. In addition, he cited reports widely current in Europe that domestic animals brought to America rapidly degenerated. It was firmly believed that not only did cows, horses, pigs, and other barnyard denizens become smaller and runtier, but they fell off in production. Cows in America, it was said, produced milk in quarts where in Europe they yielded in gallons. Speaking of the indigenous tribes of America, Buffon wrote:

"The American Savage, it is true, is little less in stature than other men, yet that is not sufficient to form an exception to the general remark—that all animated nature is comparatively diminutive in the new continent. In the savage, the organs of generation are small and feeble; he has no hair, no beard, no ardour for the female; though more nimble than the European, from being habituated to running, he is not so strong; possessed of less sensibility, yet he is more timid and dastardly; he has no vivacity, no activity of soul, and that of the body is less a voluntary exercise than a necessary action occasioned by want. Satisfy his hunger and thirst, and you annihilate the active principle of all his motions; and he will remain for days together in a state of stupid inaction."

To account for this degeneracy, Buffon spoke like a true eighteenth century naturalist and attributed it to the American environment and in particular to the fact that America, having only recently emerged from the sea, possessed a "watery climate" which was less favorable as compared with the presumably drier and more invigorating climate of Europe.

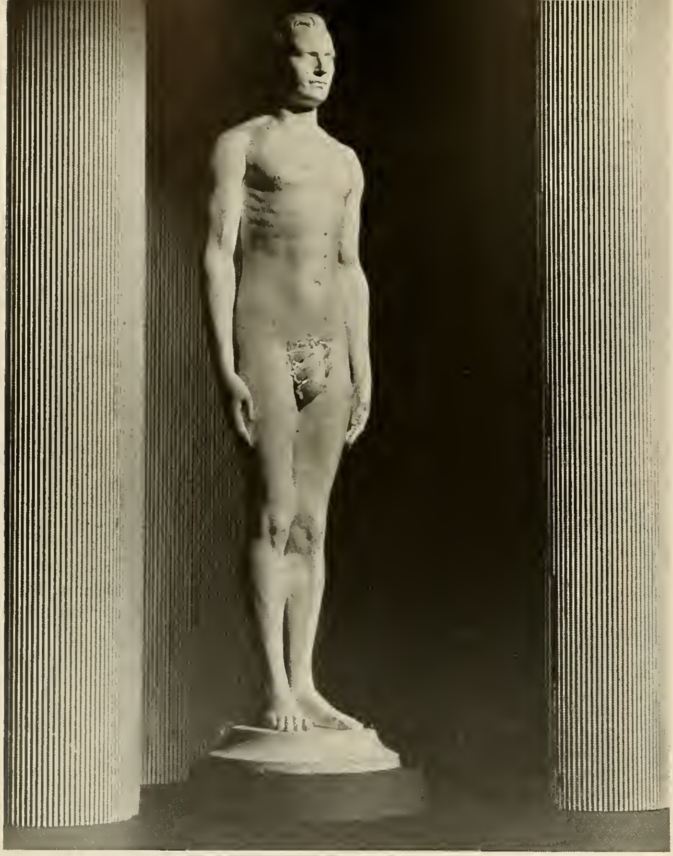
This then was the hypothesis that Raynal took up and expanded to include all the human fauna of America, aboriginal and transplanted. At this point, Thomas Jefferson took up the cudgels and belabored Raynal and Buffon with tables of comparative weights that left no shred of comfort to his opponents. In instance after instance Jefferson demonstrated that the American species were distinctly heavier and that, if weight alone were any criterion of quality, there could be no doubt that the superior article was to be found over here. Whether our climate were watery or not, Buffon and Raynal were certainly all wet.

Although this footnote in our history is amusing in view of what has actually happened to the physical development of our population, it throws no light on eighteenth century opinion on the progressive development of a native type except in so far as it was alleged to be a degenerating one. Local differentiation to some extent was recognized, to be sure, and the Yankee as contrasted with the Southerner was becoming a stock figure; but the distinctions were based largely on manners, attitudes, and way of life, although physical differences seem not to have been completely ignored. In this period, too, the frontiersman began to crystallize as a physical type, although the characteristics that marked him are not always consistent or explicit. It is, however, only after the Revolution that one becomes aware of a growing tendency of Americans to think of themselves as a nation—as Americans, despite the tendency of the Virginian or the New Englander to cling to a local allegiance. This increasing sense of a common nationality found expression in the opening years of the nineteenth century in the discovery of a representative type in Uncle Sam, who rapidly gained a national personification that has continued to the present day.

How much truth there was in Uncle Sam is a matter of conjecture. Tall, lean, long-legged figures seem to have become frequent enough among Americans of this period to have attracted comment as symptomatic of a national trend, but it is unlikely that Uncle Sam approximated anything like an average of the total population at the time of his creation. Perhaps, like a caricature, he owes his being to a deliberate exaggeration of an actual but subtle tendency in the population. He was, in other words a type of some frequency in the general population but not an average, and his selection to represent the nation rested on the fact that as a type he was to be found more characteristically here than in other countries.

Since Uncle Sam was not the *average* American of 1800 (at least we have no evidence that he was), it would be profitless to compare him with the American of today in an effort to determine whether or not the American people have altered appreciably in the course of 150 years. We have, fortunately, for our contemporary population the kind of data that was completely absent in 1800. Although the material now available falls short of perfection, it is extensive enough to give us an excellent idea of the average dimensions and proportions of the American man and woman of our own times,—the kind of summation impossible for earlier periods in our national evolution. The principal sources from which the reconstruction of the average American male and female may be drawn are varied. They include the information made available by a survey of a couple of million men in the army during the first World War, special studies of the old American stock, series of college men and women from various parts of the country, a sample measured at the recent World's Fair in Chicago, insurance company records, and extensive data obtained by the Bureau of Home Economics on 15,000 American women who were measured in detail to provide more accurate dimensions and proportions for sizing women's ready-made garments.

Recently, a distinguished team of co-workers, Dr. Robert L. Dickinson and the well-known sculptor, Mr. Abram Belskie, who have collaborated in the past to produce a unique series of anatomical models, turned their talents to creating models of the average American male and female in the full flush of early maturity. Their results, embodied in the two handsome figures sculptured at one-half life size, which are reproduced on accompany-


A.M.N.H. photo

▲ NORMA'S TWENTY-YEAR-OLD "BROTHER" is also a product of Dr. Dickinson's studies and was modeled by Abram Belskie. Both of these statues and the measurements on which our knowledge of physical trends is based, leave little doubt that the figure is improving esthetically

ing pages, translate into three dimensions a composite of the available data. The female figure, named "Norma" appropriately enough, represents the norm or average American woman of 18 to 20 years of age. "Normman," her male counterpart, is modeled on averages for 20-year-old males.

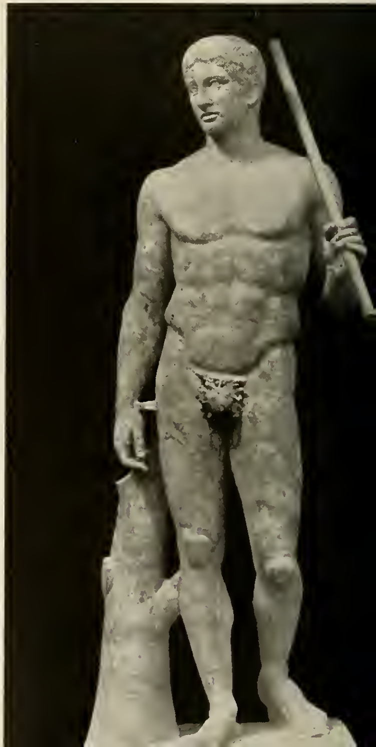
The effect these figures convey is one of a body that is tall, long-legged, and well proportioned, and far more favorably impressive, at least esthetically, than might have been anticipated from casual observation. In fact, Norma and Normman, although they were designed to conform with the average adult before the onset of the ravages of age, exhibit a harmony of proportion that seems far indeed from the usual or the average. One might well look at a multitude of young men and women before finding an approximation to these normal standards. We have to do here then with apparent paradoxes. Let us state it this way: the average American figure approaches a kind of perfection of bodily form and proportion; the average is excessively rare.

Ordinarily, when we think of perfection, or the approach to it, we place it at one extreme of a curve of frequency, whose middle range or average is equivalent to mediocrity. Virtuosity, for example, is never at the middle of a curve of frequency. The most skilled musicians, the finest painters, the loftiest intelligences are rare and exceptional, never average for any population. Why, then, should the average bodily proportions strike us as a form of perfection; and if it is average, why is it rare? There are, of course, esthetic and anatomical considerations involved here, but I shall confine myself to a statistical explanation. The extremes of any single physical character are generally statistically rare, whereas the average is frequent. The middle ranges of stature are most commonly seen, the average weights most often recorded, the mean of a bodily proportion is the most usual.

All these averages are in themselves individually pleasing, and they are common and usual, observed singly. A very fat lady and a very thin one are both rated ordinarily as less attractive than one of more average weight. Obviously, then, if the averages of all traits are brought together in one individual, such a person is bound to agree with the standard not only for one but for all the characters that define bodily proportion. But the combination of so many averages in one person is rare and unusual. One may have an average stature but be far above normal in weight; another may conform to the average for height and weight but possess hips or shoulders that fail to achieve the mean. Thus it comes about that the

▼ DORYPHORUS, THE SPEAR THROWER: a Greek ideal of about 400 B.C. This figure, 7½ heads high, exhibits a massive torso and well proportioned limbs, combined to give an appearance of power rather than agility or speed

Courtesy of the Metropolitan Museum of Art



average physical type is pleasing but also unusual.

▲ **The average young man and woman of the Gay Nineties as portrayed in two figures scientifically constructed by Professor Dudley A. Sargent. Both were shorter than their modern counterparts. The woman also had a narrower waist than her "granddaughter"**

Bodily perfection like any other esthetic ideal is admittedly a matter of taste, a subject that may be dismissed with the phrase, "*de gustibus non est disputandum*," or carried into rarefied levels of sensibility. It is, however, interesting to compare Norma and Normman as created by Dr. Dickinson and Mr. Belskie out of the realities of living Americans with the ideal figures conceived by the classic masters according to artistic canons of bodily proportion. The archaic Greeks, bound by the traditions of Crete and Egypt, deliberately carved statues with exaggerated and often unlife-like proportions, and it is not until the fifth century B.C. that we find the classic figure fully developed. The sculptors of this period strove to create a harmonious and ideal body based on the proportions of living men and women but brought to a higher perfection of abstract beauty. It is an idealization rather than a copy of a living model. One of the most celebrated sculptures of this period is the Doryphorus by Polycletus (about 440 B.C.) which, because its proportions were regarded as approximating perfection, was known as the Canon. The height of Doryphorus is $7\frac{1}{2}$ heads (measured from the base of the chin to the crown of the head). Compared with it, the average American male is much taller, (though still about $7\frac{1}{2}$ heads high), and much more slender not only in the limbs but also in the torso. Somewhat later Greek sculptors like Lysippus (about 320 B.C.) lengthened their figures to 8 heads, but the solidity of body remains when contrasted with the modern American. The Venus de Milo, also 8 heads high, a proportion that agrees with that of Norma, is, however, much broader in development, with hips that look massive against Norma's relatively slender ones.

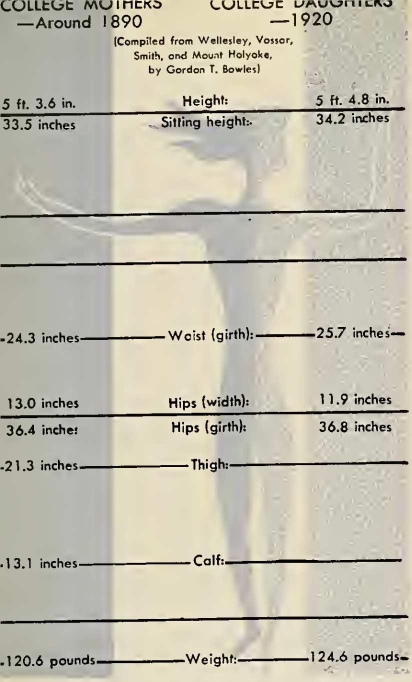
▼ **The early Greek ideal in feminine beauty is seen in the statue of Aphrodite of Cyrene, sculptured in the second century B.C. after a fourth century type**

Courtesy of the Metropolitan Museum of Art

Since classic sculpture represented an ideal and not an average, we are warranted only in concluding that our averages of today are deficient judged by classic concepts of ideal beauty. Who can tell how far the contemporaries of Pericles were wanting by the same measures of perfection?

But modern notions of bodily harmony have changed. The world of fashion and photography, for example, favors an ideal and a canon distinctly its own. The "high fashion girl," whose elongated and elegant grace we see in the pages of the slick magazines and in the advertisements of high priced garments for women, is eagerly sought after as a dress model and much admired by the public. Her broad shoulders, slender hips, and long legs show off clothes to their best advantage and thus help sell the product she displays. Is she a type that suits the prevailing trend of a fashion that might tomorrow leave her demodé, or does fashion follow her contours because she represents an exaggerated but elegant form of a changing bodily conformation in American women?

That the American woman, no less than the American man, has been changing in physique has been frequently asserted and is well known to clothing manufacturers, who have been obliged to make a number of alterations in their sizing formulae to fit the public. Our elders who have commented, sometimes unsympathetically, on the changes to be seen in the younger generations, may refresh their memories of their own intimate appearance of 50 years ago in the illustrations of Professor Dudley A. Sargent's figures of the average col-



The college daughters of 1920 were taller and heavier than their mothers but had relatively narrower hips

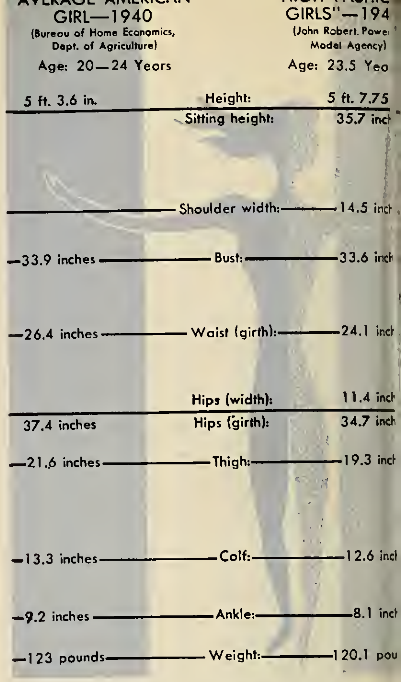
lege man and woman of the gay 90's. These models were constructed from a large series of measurements of Harvard and Radcliffe students and make an illuminating comparison with the "Norma" and "Normman" of 1945. If the Sargent reconstructions are as representative for their day as the Dickinson-Belskie models are for the present generation, there can be no question of the esthetic improvement in the present population. The girl of the 1890's had a constricted waist, the effect no doubt of corsets and the hope of achieving a girth that could be spanned by a man's two hands, if such liberties were thinkable. She seems, moreover, somewhat disproportionate in having legs too heavy for her torso, or, if one prefers, a torso undeveloped for the size of her hips and legs.

We are fortunate in having at our disposal for such a comparison with the past an abundant body of exact evidence that leaves no room for doubt that a marked change has occurred in the physical development of our population. Repeated measurements on the students of various colleges throughout the United States all agree that this generation is considerably and consistently taller than its parents.

One of the most extensive series in time covered is the Harvard study, which embraces a continuous record of around 75 years. Dr. Gordon Bowles, who has analyzed these figures with great skill, has been able to demonstrate a remarkable increase in size and an alteration in proportion in Harvard undergraduates as well as in college women in a number of Eastern schools. To indicate the rapidity and magnitude of the change, I shall cite the average statures of Harvard students by decade of birth. Beginning with 1856-65 and continuing by decades up to 1906-15, the average statures are as follows: 5′ 8″, 5′8⅔″, 5′9″, 5′9½″, 5′9⅘″, and 5′10″. Sons compared with fathers increased 1.38 inches in height, gained 10 pounds, developed broader shoulders and narrower hips. College girls compared with their mothers added 4 pounds to their weight and 1.15 inches to their height. They have expanded around the waist by almost an inch and a half (from 24.2 inches to 25.65 inches) and around the hips by less than one-half inch (from 36.35 to 36.8 inches), although the hips have actually decreased in width by an inch. The daughters also seem better developed in other ways too. They have chests that are an inch greater in circumference and are capable of a greater expansion. Their arms are slightly larger in girth, presumably being more muscular.

This is far from being an isolated phenomenon, confined to the college population and restricted to those born in specially favorable circumstances. Neither is it characteristic only of one stock in our national "melting pot." College records from north, south, east, and west, from endowed, expensive schools and from state universities parallel the trends uncovered in the Harvard sample. Growth studies on children repeated on the same population after the lapse of a generation or more disclose the same marked increases. Mothers who buy for Johnny aged four, suits sized for age 6 or 7, know this without benefit of science. Children are growing at an accelerated pace and reaching within the growth span a greater size. Since all parts of the body do not continue to grow at the same rate but follow a gradient, certain alterations in proportion follow upon this expansion in height.

So far as the evidence is available, this progress, if one may call it that, of the American type affects all our



The average girl today is stockier than the College Girl of 1920, but her height is likewise increasing. Her bust measurement exceeds the "high fashion" girl's, but she is four inches shorter

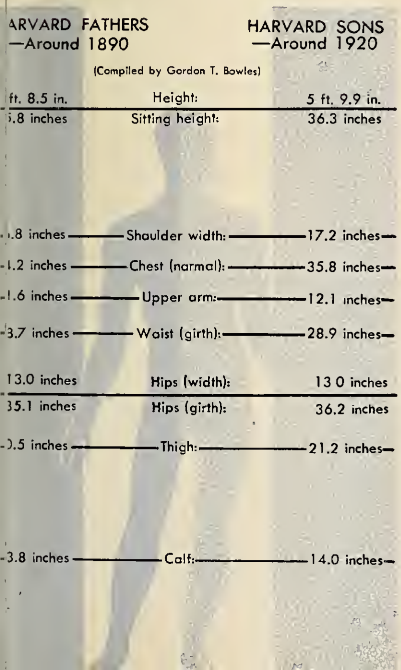
population regardless of origin. As long ago as 1912, Professor Franz Boas published his inquiry into the effects of the American environment on the bodily form of recent immigrants. He found that the children born in the United States of European immigrants were appreciably modified from the norms of their parents. My own investigation on the Japanese in Hawaii, although concerned with a different stock, led me, after controlled comparisons with the sedent population in Japan, to conclude that physical type is plastic under changes in environment and capable of significant alterations in size and proportion.

As a result of this increasing stature of the American people, both the new and older stocks, our average now surpasses those of the various European countries from which our population is derived. It should not, however, be assumed that the people of the United States alone are undergoing this expansion in height. In various parts of Europe, in Japan, and in other areas where statistics are available, the same process seems to be affecting mankind. Here in America it is apparently accelerated but not unique.

Even if this trend should appear desirable and we take pride in our rising statures, we should soon reach a point where further increases would become rather alarming. If stature has been increasing steadily for the past 75 or 100 years and our college men already have attained a mean of 5 feet 10 inches, where will it all end? Are we experiencing a transformation into giantism, with averages of 6 feet 6 inches or 7 feet within several hundred years or so? Are we headed for ungainly dinosaurian proportions that will lead to our extinction? Professor Mills, of Cincinnati, says no. His recent analysis of the latest data reveals a slowing down of the process, which presumably means a stabilization or possibly a reversal in the trend.

The precise cause of our increase in size is not completely understood. It has been attributed to a variety of factors, among others to improved nutrition, better care of our young, and advances in public health. But none of them seems entirely satisfactory since some of the tallest men in our army of 1917-18 came from areas that enjoyed none of the advantages in nutrition, medical care, and public health that we often think are typical of all parts of the United States. That nutrition, for example, does influence the growth cannot, on the other hand, be denied. Numerous studies on growth agree that children on better regimens do grow more rapidly and attain greater size than their less fortunate fellows. We are probably confronted here with a complex phenomenon which defies an explanation based on a single variable.

HARVARD SONS were ten pounds heavier than their fathers, 1.4 inches taller, and had shoulders 4/10 inch wider

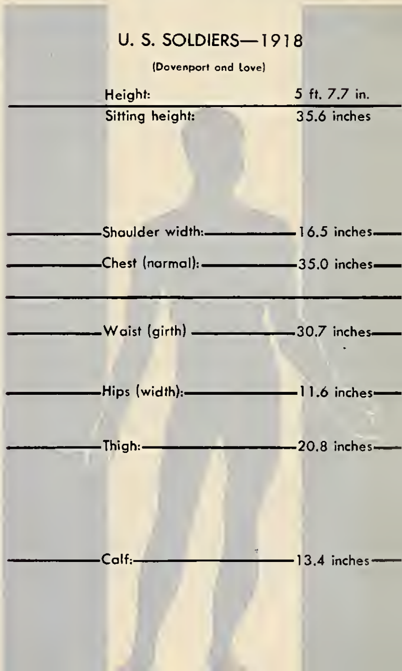


It may well have occurred to the reader by this time to wonder how far the American people are evolving a characteristic American type fundamentally distinct from those of our European contemporaries. Indeed, it was firmly believed at one time that Americans were gradually assuming the aspect of an Indian, on the hypothesis that the same environment that produced our predecessor was transforming us into his simulacrum. Peter Kalm, the Swedish botanist who visited the United States in the middle of the eighteenth century, professed to find "that the French, the English, Germans, Dutch, and other Europeans, who have lived for several years together in distant provinces, near and among Indians, grow so like them, in their behavior and thoughts, that they can only be distinguished by the difference of their colour." But even this surviving mark of distinction was thought by some to be disappearing. The president of Princeton College, Samuel Stanhope Smith, D.D., observed in 1788 that a change had already become manifest in the Anglo-Saxon and other European inhabitants of America, both in complexion and feature, and he further maintained that if the colonists were thrown like the Indian into a state of absolute "savageism" they would soon be marked by the same complexion.

This belief seemed to enjoy a persistent adherence, because as late as the middle of the nineteenth century Dr. Carpenter, writing in an English cyclopedia remarked, "It has not been pointed out, so far as the writer is aware, by any ethnologist, that the conformation of the cranium seems to have undergone a certain amount of alteration, even in the Anglo-Saxon race of the United States which assimilates it, in some degree, to that of the aboriginal inhabitants. Certain it is, that among New Englanders more particularly, a cast of countenance prevails, which usually renders it easy for any one familiar with it, to point out an individual of that country in the midst of an assemblage of Englishmen. . . . And it is not a little significant, that the well marked change which has thus shown itself in the course of a very few generations, should tend to assimilate the Anglo-Saxon race to the aborigines of the country."

So do errors reverberate down the corridors of time. An echo of this strange doctrine came to my ear not very long ago via a well known professor of English literature who repeated this fantasy with complete conviction. If this were indeed true, then those who, referring to the United States, have urged that we "give it back to the Indians" might have been speaking with more poetic justice than they expected. But any such fanciful notion must be laid aside. The American of today remains a close derivative of the stocks that have settled here, but he has at the same time undergone modifications from his ancestral types. His deviations from European norms are either the results of mixture among the various representatives of Old World types or the consequence of an increased size with the attendant changes in bodily proportion that follow on such a quantitative expansion.

THE SOLDIER of 1918 was shorter and lighter than the Harvard student but had a larger waist. Figures for the soldier of 1945 are not available



We watch Beetles

By Lorus J. Milne

With the assistance of

Margery J. Milne*

(*With illustrations by the authors*)

If you had only two weeks' vacation all year, would you want to spend it watching beetles? Neither did Margery! That the beetles in question would be burying small dead animals, often at night, was no selling point. "Besides," she argued, "watching any kind of beetles, no matter how interesting, is no way to relax after another 50 weeks of war research."

A major campaign is required to convince my wife, especially when she's right. This was to be no exception. But I grew enthusiastic, describing the observations I had made on these beetles many years before, telling how spectacular were their odd habits. "Think of an insect an inch long," I said, "carrying the dead weight of a full-grown mouse or robin, moving it six, ten, fifteen feet in a few hours from hard ground to soft, and then burying it, all to provide food for several offspring." Still she was not convinced.

From our bookshelf I pulled down a well-worn field manual of entomology and showed her among its respected pages that the burying behavior of these insects was questioned by experts, believed by some to be wishful thinking and nothing more. We could make a motion picture record of the procedure, to settle once and for all that the beetles did do as I described. Margery began to waver. "It would be a definite scientific accomplishment," I pointed out, "well worth presenting before biological societies." Sold! Margery always falls for a proposed scientific advance. Well, almost always!

Two weeks' vacation can vanish overnight, it seems, unless it is well organized in advance. Each day must be planned to get the most done. To decide on a method, we ought to know as much as possible about the burying beetles, to see what others had written on the subject. Unpleasant jobs like this have always been wifely work, and Margery took it on. Beetle-like, she buried herself in the libraries of the Academy of Natural Sciences and the University of Pennsylvania, digging out the information others before us had gleaned. She even struggled with French and German observations and finally emerged surprised and elated over the whole idea.

▲ The author and his wife, Lorus and Margery Milne, making photographic records of their findings. The mouse, which was used as bait for the

To improve our chance of getting the photographic record wanted, we wished to find a cottage in northern Ontario as near as possible to the spot where I had seen the beetles at work in former years. We should spend little time in going and coming so as to have most of our two weeks "on location." We had to decide how much Kodachrome movie film we would need, and many other details. But our biggest worry was what to

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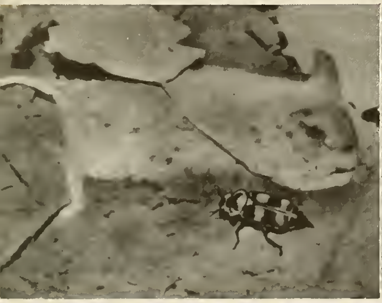
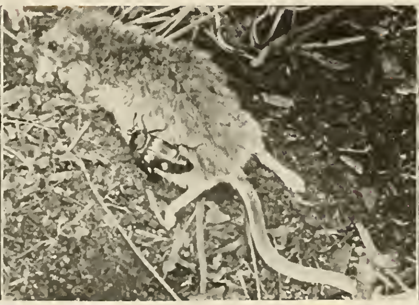
*Mrs. Milne is Assistant Professor of Biology at Beaver College, while Dr. Milne does dual duty in war research on visual problems at the University of Pennsylvania and in scientific writing for the Bausch and Lomb Optical Company of Rochester. Before the war he, too, was a biologist. Both of them have doctorate degrees in biology (Radcliffe and Harvard) and have published many scientific reports on their research work.—Ed.

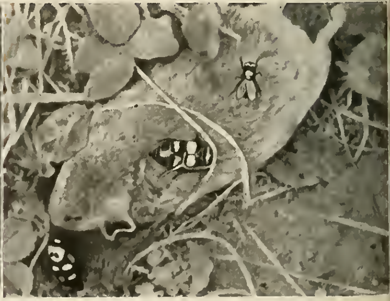
▼ The beetle that can move a mouse 15 feet. Among the dead leaves, the mouse appears well camouflaged, but the sexton beetle soon finds it by sense of smell

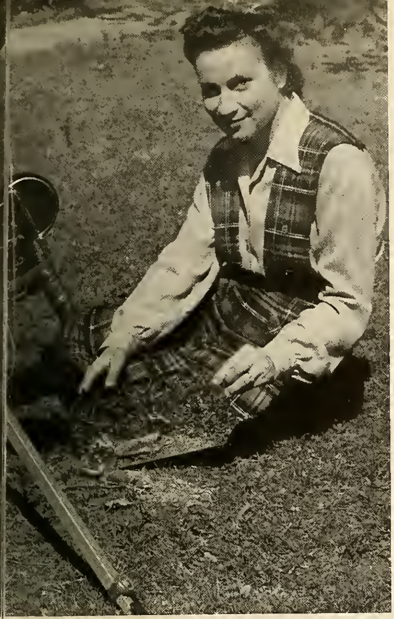


▼ After moving the carcass a short distance, the burying beetle surveys its work from atop the mouse



▼ One of the sexton beetles is stretching a clover stalk that hampers movement of the mouse. A moment later, the other beetle pulled the mouse forward a short distance





beetles, may be seen both on the ground and reflected in the mirror, which Mrs. Milne is holding in order to provide additional light for the picture

When two students of insect life take their only vacation to study and record the amazing habits of this tiny beetle, it is indeed a strange occurrence—and what they find is stranger still

do if we found a rentable cabin, got to it with cameras and film, and then found that the beetles no longer inhabited the region. After all, it was sixteen years since I had been in that vicinity!

We decided to risk it. We even became resigned to shipping our tenting equipment to the nearest station if no cabin could be had. We had tented happily all over the United States; there was no reason to exclude Canada from our list. Friends spared us this difficulty by finding a fine cabin for us quite near the site of previous observations. We obtained our Kodachrome film and selected the last two weeks of July as the time when the beetles (if any) would be at work and when the weather was most likely to be sunny and suitable for color photography.

The day we arrived was beautiful, sunny, and warm, just as planned. I had brought along two mouse traps with which to catch beetle bait. Loading them with peanut butter, we hurried to set them out in likely spots, then stretched our legs a bit, exploring the hilly country near the cottage, admiring the stands of paper birch and evergreens, the great outcroppings of ancient granite, and the rust-colored streams and lakes. Returning from our hike we saw a line of sheep straggling from where we had hidden one trap to a group of the same animals around our second. As we approached we heard a sudden snap, which caused a momentary panic among the sheep. Since the trap made no further menacing gestures, an old ewe proceeded to lick up the rest of the peanut butter. Both traps were cleaned of bait! We chased the sheep over the hill, reloaded our traps, and hid them in new positions where the sheep would be less likely to molest them.

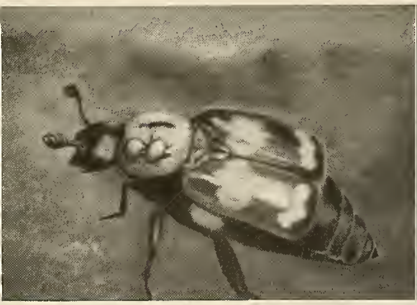
In the evening we climbed over the hill to check our traps, but nothing had happened to them. We continued our walk to renew acquaintance with the two neighbors who lived half a mile from the cottage, permanent residents who had been very friendly and helpful years before. Not suspecting our motives they welcomed us with open arms. "Well, Lorus, it's good to see you again! We have spoken of you often and the way you always used to carry a bug net. And so this is your wife! How do you do, Margery . . .!" "Mice! Mercy, you want dead mice! Do you mean you *still* collect bugs?" Horrified, they learned that I had not outgrown such nonsense, in fact had even sold my wife on the idea of photographing the burying beetles. Well! Well! Astonishment is a mild description of their reactions.

The second day dawned clear and warm, and we hurried to inspect our two traps. No mice. To add to our disappointment, one of our neighbors had told of catching 20 mice in her grain bin the week before. She had thrown them into one corner of the dooryard, but no sign of them remained. Did that mean burying beetles were still about?

We *had* to have mice. We should have brought more traps. So to town we went over the long and twisting road. At the general store I bought some traps and then an idea struck me. To the clerk at the meat counter, I said, "I'd like a few pieces of red meat, any kind at all that's fresh, not

▼ TWO YOUNG BURYING BEETLES near the foot of their food supply

↘ THE SEXTON BEETLE pays no attention to the mites on its back or elsewhere on its body. The mites for their part move about freely, keeping the beetle clean by devouring small organic particles that stick to it



▼ TO FREE THE CARCASS for burial, a sexton beetle at midnight chews through a coarse string tied to the mouse's foot

smoked, but each piece must be about three inches long and an inch or so in diameter." Her response was a blank stare, which called for further explanation. "I want about three pieces of meat, each about the size and shape of a mouse." The stolid clerk shuddered at that. I insisted. I wonder if my order still haunts her. She gave me my ersatz beetle bait, but I slunk rather than walked from the store, feeling like a vulture.

On our return to the cottage, Margery checked the traps. I heard her shout, "A mouse! A real MOUSE, very dead!" And back she came with it, trap and all. Quickly we placed it out in front of the cabin where we could watch it while we ate our lunch on the screened porch. By the time lunch was over, a sexton beetle had come to the bait, to be followed shortly by a second. To a duet composed of Margery's amazed comment and the whirr of the movie camera, first the one beetle, then the other, began to shift the mouse and get it underground.

A second mouse, carefully sealed in an envelope as a present from the postmistress, awaited us when we called for mail two days later. More beetles, more movies, more notes! And more mice came to the trapline. Thoughtful neighbors brought a mouse, a shrew, a sparrow, or a dead turkey chick as a calling card. Our fame spread as the bait came in from miles around. For a time we actually had a reserve supply of mice in pint sealers in the ice box. *Those* mice weren't mentioned when we served our callers iced tea and cookies.

Almost everyone becomes interested in an animal if it shows evidence of care for its young. When an insect goes to great trouble to provision and protect its offspring, it is sure to attract attention. The sexton beetles show a very advanced form of parental care in a group of insects where such is not common. In many cases, a small animal may be dead less than three quarters of an hour before a pair of burying beetles have flown to the scene, finding their way by scent. The beetles may bury the carrion where it lies if the ground there is soft and free from roots and stones, or may move it some yards to a suitable site. The body is usually buried to a depth of two to three inches and worked into a ball by the attendant beetles. Feathers or hair, loosened by the normal process of decomposition, are moved aside. The female beetle lays about fifteen eggs in a little alley excavated to one side of the main chamber.

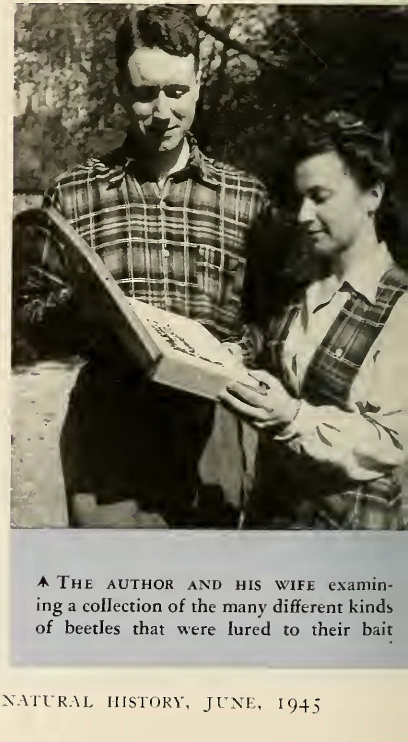
When the eggs hatch to active little yellow grubs, the parents feed on the carcass and regurgitate partly digested food for the young. After moulting twice, the grubs are very fat and sluggish and soon will be led off through the earth by the parents, away from the remains of the food mass, to pupate and change into adult beetles. There being no need for further feeding or protection, the parents leave at this time.

It is evident that the burying beetles do something to embalm the carcass, but no one knows how they do it. We are aware that destruction of the mass by maggots and similar animals is prevented by the simple process of their being eaten by the parent beetles before any significant losses have been sustained. We do not know how the watchful beetles restrain bacterial action, nor why the tissues turn quickly to a gray paste which lasts for a month or more in this condition while the young and parents feed from its surfaces. This is not the rapid drying out by which the Egyptian mummies have been explained; it is not a mummy but a food supply. It approaches the preserved eggs for which the Chinese have long been famous, but the secret has not yet been disclosed.

The ancient Egyptians knew how to prepare mummies, but they were highly interested in another kind of beetle which worked in pairs, rolling a ball of dung on which their offspring were to feed. This activity led to reverence for the beetle as the "sacred scarab," and when later the Roman legions overran Egypt, the same beetle was adopted as an emblem for their flags. Yet no one seemed to know that when these scarabs have rolled their ball to a suitably soft site, they bury it much as do sexton beetles!

Similarly the sexton beetles were known for many years to transport dead mice and other small carcasses. Their scientific name, *Necrophorus*, refers to carrion carrying and was given to the beetles in the late 1700's. Still few had watched the insects at work, and although they are widespread in the northern hemisphere, their life history was not described in detail until 1933. The burying habits especially have rarely been observed, and many scientists have doubted that these beetles could possibly show such ingenuity and ability. In part this is due to the preference shown by sexton beetles for nocturnal activity. Flies offer less competition then. However, this can not be the sole explanation of ignorance concerning them, since some of the scientists who have studied these insects in recent years have experienced difficulty in following the beetles prior to the completion of burial. Several report spading up many square yards of soil around the spot where a dead mouse had been set out as bait, all to locate the buried carcass and its attendant beetles.

Sixteen years ago I had realized that a mouse or bird set out as bait could vanish in an hour or so unless tied securely to a stake. In fact, tying the bait with a string did not solve the problem since the beetles can cut a string in a short time. Fine steel wire, however, presented an insuperable obstacle to beetles attempting to carry their trophy to a more suitable burial place. Scientific curiosity might in time have led to this discovery, but spading up large areas of rocky ground for buried bait is wearisome, and I have always suspected that laziness



▲ THE AUTHOR AND HIS WIFE examining a collection of the many different kinds of beetles that were lured to their bait has mothered more inventions than necessity ever did. Anyway, my earlier interest was in collecting the beetles, and how could this be accomplished more simply than by pulling on a wire to disinter the buried mouse and the pair of insects?

We were anxious to get a motion picture record of beetles cutting a string to free a mouse for burial. After many attempts we decided to tie a coarse string to one hind foot of the mouse, and have the cord extend almost vertically to its attachment point on a near-by stake. A pair of large sexton beetles attempted to bury our bait. Finding that they could not transport the mouse away from the stake, the insects proceeded to loosen the earth immediately below the bait. Soon they had not only broken the soil into small fragments and freed it of roots, but they had produced a cup-shaped cavity over which the mouse dangled on the end of its tether. The cup became larger than the mouse by the thickness of the beetle's body all around and underneath. The insects tried and tried to get the body to fall into their pit. They tugged and they pulled. They rotated it over the cup, first one way, then the other. No luck! The mouse's tail dragged on the cup's rim. Perhaps it was holding the mouse. First one beetle would investigate the tail, then the other, each crawling along the length of the tail from base to tip to see that it was free. It was, but the traffic became so heavy and the mouse so ripe that the skin slipped off the tail like a glove finger. Still the mouse was suspended. One beetle settled on the base of the tail and slowly gnawed it off. Although there was no change in the mouse's position, a beetle now attacked the string.

To get our photographs of the string-chewing, I sat by that mouse with camera trained all afternoon, while the beetles rotated the body over the cup and chewed on the tail. My supper was served beside the camera. Darkness fell and mosquitoes arrived. The string-chewing was finally shot by the light of a flashlamp with the telephoto lens wide open. The colors are good on the Kodachrome record, and the beetle chews magnificently! The patient Job would have made a good insect photographer! My mosquito bites swelled up like his boils.

We had reason to be glad that our tent was in storage and that we were living in a cabin with a good roof. The first two days were almost the only ones in which it did not rain! Thereafter we did our picture taking in short bursts between showers. We brought in the mice each time to keep them dry and photogenic, then rushed them outside and prayed for beetles at the first hint of sun. One evening we were particularly tired and disgusted with the weather. Instead of putting all our bait away, I tossed one overworked mouse into a butterfly net and, folding the net bag on itself several times, leaned it all against the cottage for the night. In the morning we regretted my haste. Beetles had come to the net, and while the old mouse was still there, so were the beetles, having chewed great holes in the layers of Brussels net to reach the carcass. Only the number of layers of netting kept the many beetles from fighting with each other. Only two had actually reached the body, both large ones. Concern over the sad state of the net kept us from learning how the ingenious beetles would have freed the mouse for orthodox burial. How often have emotions come in the way of scientific observation?

Because of the rain, the insects were most exasperating at times. Fine sun, good mouse, camera ready, photogenic beetles at work, and then they would run off to explore surrounding areas ten to twenty feet away, or would rest for ten minutes with heads among a clump of grass roots. Then as though at a signal, back they would come and all would be fine for photography except that the sky was clouding, a large tree cast a dense shadow on the mouse, the cameraman's assistant had deserted him for some other task, and there were 25 flies, more or less, around the bait!

Three kinds of sexton beetles came to our bait, two of them commonly. One of the two was a large variety, the other not over three-quarters of an inch long and usually much smaller. Size was no guide to sex but it was to disposition. The large type consistently drove away the smaller, and never more than two of the big fellows worked on a single carcass. The smaller kind was more sociable, three often co-operating in transporting a mouse and through the early stages of burying it. Never more than a single pair remained with a mouse, although two pairs of the small type shared a young turkey. A 30-inch garter snake was buried and attended by two pairs. Apparently the amount of food required by a brood of young determined whether a particular carcass could be shared. The pairs that finally stayed with the carrion were always composed of a male and a female. Sexton beetles arriving at a body that was being moved or buried by a pair were usually driven off at once. Only the large kind was able to dispossess the original "owners."

We tried experiments to test the "ownership" sense. Our friends say they were diabolical. Probably so. We would place a second mouse of similar vintage a foot away from bait on which a pair of beetles were working. During their rest periods, the insects invariably discovered the additional carcass but never did they desert the one found first in favor of the second mouse. They were obviously confused by the extra bait, but examination of it was always followed by a hurried return to the original carcass. We even tried interchanging mice, so that location of the carrion would give no clue. Still there was no swerving in the beetles' loyalty. The first-found bait was IT, and no other could be substituted.

One garter snake innocently gave us a great deal of amusement. A neighbor discovered beetles burying it one evening. She erected a stake to mark the spot and came panting over the hills to tell us about it. It was too late for pictures, but in the morning the sun rose and we hurried down with our equipment. As we set up the cameras, our neighbor spotted us from her house in the distance and came on the run to see the excitement. Her slender niece and a large, well rounded house guest were at her heels. Had our supply of Kodachrome not been dwindling fast, we could have taken a priceless scene of all of these friends down on their tummies, squirming under a high wire fence rather than take time to go around by way of the gate! A few minutes later I was ready to start digging out the snake, and Margery was to operate the movie camera. The scene progressed nicely but two beetles came to the surface and seemed ready to fly away. Without thinking, Margery grasped a beetle in each hand and held them out to our neighbors. "Please hold these while we get the rest of the scene." Now, our friends were very much interested as spectators, but

Continued on page 290

A Green Goliath meets its Desert David

By NATT N. DODGE

ALL PHOTOGRAPHS BY NATIONAL PARK SERVICE

A tiny moth and the long-gone pioneers of southern Arizona threaten the life of the saguaro—State Flower of Arizona and symbol of our Southwest. Is it worth saving?

◄ SEASONED TOURISTS exclaim over the unworldly atmosphere produced by the weird Goliaths of the desert

When President Herbert Hoover in 1933 established Saguaro National Monument, conservationists believed that a unique part of America, the finest of the nation's rare forests of the giant cactus, was preserved for posterity. But conservationists, and every one else, were blissfully unaware of two vital factors: the long-gone pioneers of southern Arizona, and a tiny moth. This peculiar combination has recently risen to threaten the people of the United States, and especially of Arizona, with the possible destruction of their Cactus Forest*

The huge, leafless, stiff-armed candelabrum of the desert gave Arizona its State Flower and has become a trade-mark of the entire Southwest, although its range is limited to Old Mexico, southern Arizona, and extreme southeastern California.

The saguaro (pronounced suh-WAH-roe) represents one of Nature's most interesting and highly specialized botanical developments. Reaching a height of over 50 feet, a weight of twelve tons, and a maximum age of about 200 years, the saguaro is truly a vegetable Goliath. And a forest of these spine-sprouting monsters, like the crowded spears of a dragon-tooth army standing silent guard over the hills of Arizona, is a spectacle guaranteed to thrill even the most sophisticated tourist.

Move closer to one of these desert Goliaths and you will begin to see how it is able to raise its fluted stems in defiance of blazing sun and parching wind. Leaves, which permit the escape of much moisture, have been discarded, and tough green skin has taken over their food-making function. The dense growth of spines helps to break up steady currents of hot, dry air, further lowering surface evaporation. The shallow root system of the saguaro forages widely for moisture. During the few soaking rains of winter and the sudden, spotty downpours of summer it takes up enormous quantities of water. The wrinkled, fluted exterior of the plant gradually expands like the bellows of an accordion as the spongy tissues fill with water, and the cactus takes on a swollen, bloated appearance. During unusually wet winters, an occasional saguaro may split open from the internal pressure of moisture it has absorbed. The saguaro is an immense vegetable water tank that drinks like a glutton and then guards every drop of moisture.

Although a saguaro may live to be 200 years old, most of them succumb earlier to a bacterial disease to which they become increasingly susceptible after reaching full maturity.

During its adult lifetime, each plant produces and scatters billions of seeds, not one of which may be successful in escaping its numerous enemies and developing into a saguaro plant. The occasional seed that does happen to fall in a protected spot where conditions are favorable for germination and manages to avoid destruction beneath the trampling hoofs of grazing cattle or by plant-eating rodents, grows almost imperceptibly during its first two decades. "It is often ten or fifteen years before the seedling saguaro becomes large enough to be noticed," states Dr. Forrest Shreve of the Desert Laboratory in Tucson, Arizona, "and twenty to thirty years before it begins to raise its head above the shrubbery that has sheltered its infancy."

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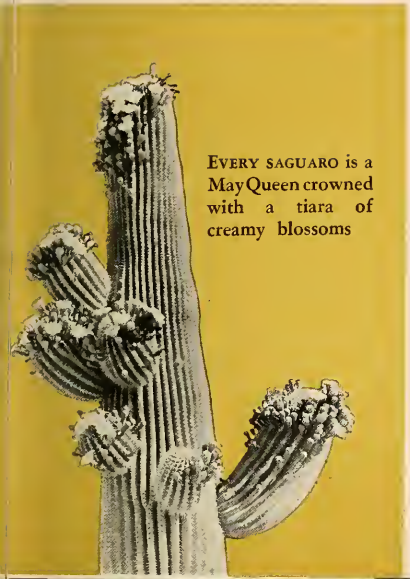
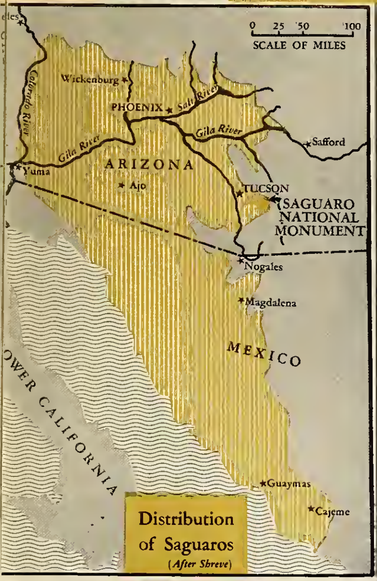
*A shorter discussion of the threat to the Cactus Forest was published in NATURAL HISTORY soon after the Department of Agriculture began its intensive investigations: "Death in the Desert," by Lake S. Gill, in the issue for June, 1942.



Every saguaro is a May Queen crowned with a tiara of creamy blossoms



Distribution of Saguaros

(After Shreve)

Life begins at thirty

A saguaro 30 years old is about three feet tall and fully protected by an armament of spines against molestation by desert animals. Supported and nourished by a root system like the radiating spokes of a wheel, the young plant begins to put on height and may grow three or four inches each succeeding year.

When eight or ten feet tall, it reaches the first flush of maturity and is ready to blossom. Buds appear in April on the crown of the plant. On older saguaros, buds crowd the tips of all branches as well as that of the main trunk and, as if they had spilled over, may burst out down the side of the stem for several feet. The flowers open at night, exposing their creamy petals around a velvety center of golden anthers. They close during the afternoon of the following day, never to open again. However, only a few of the horde of buds open on any one night, so the plant may remain in flower for several weeks. The crown of blossoms makes the saguaro ruggedly beautiful and spectacular.

The blossoming saguaro is a source of food for swarms of insects that seek the flowers for their sweet nectar and protein-rich pollen. Insects, in turn, attract flycatchers and other insect-eating birds. By July, the flowering period has ended and the first of the saguaro fruits are beginning to ripen. Resembling small cucumbers, they occupy the tips of the trunk and arms where the flowers have withered. When fully mature, they split open, revealing scarlet interiors almost as spectacular as the display made by the creamy blossoms. The pulpy center of each fruit contains a mass of tiny, black seeds. Pulp and seeds are sought by rodents, which miraculously scale the spiny stems of the tall plants or pounce on the windfalls as they reach the ground. Birds consume the sweet pulp and nutritious seeds, and the Pima and Papago Indians migrate from their villages to harvest camps and gather tons of fruit. Seeds, pulp, and juice are separated and prepared for storage. Seeds are ground into rich, oily meal and pressed into cakes; pulp forms the base for jams and preserves; the juice is boiled to the consistency of syrup and provides the Indians with their principal all-year source of sweets. So important was the saguaro in the economy of the Papago Indians before the coming of white men that their calendar was based upon it: the saguaro harvest ushered in the Papago New Year.

Man and beast, bird and rodent, all have been harvesting saguaro fruits since long before Coronado in 1540

▼ **Can any State** boast of a more spectacular and unusual State Flower than Arizona's saguaro blossom?

▲ **Like a million** spears held high, saguaro arms of the Cactus Forest reflect the brilliance of the desert sunshine

first recorded the plant and Casteñada described it as a "giant thistle with fruits that open like a pomegranate." Thus, even before the coming of white men, the saguaro was encountering plenty of difficulty in reproducing itself. The few that survived as tiny plants, usually beneath the friendly shelter of the mesquite, ironwood, or other shrub, still had to run the gauntlet of moisture-hungry rodents. The intricate and delicate balance attained by Nature under settled conditions of long duration gave the saguaro a reasonably secure position in the complex plant and animal community of the Sonoran Desert. But, as with all life in a stabilized community, the introduction of a new factor could easily upset the balance and start a succession of events that would bring tragedy. This is what happened, and the new factor was the white man.

Coronado and his conquistadores passed through what is now southern Arizona in 1540, and Father Kino brought domestic livestock, cereals, and other manifestations of European civilization to the desert in the 1690's. But it was not until 1776 that the village of Tucson was established. As a major station on the famous Butterfield Stage Line to California and a supply base for punitive expeditions against the marauding Apaches, Tucson developed into a thriving outpost of civilization. Woodcutters ranged farther and farther afield, harvesting the mesquite and ironwood that fringed the desert washes to supply fuel for village fires and fence posts for the settlers. In the foothills of the Tanque Verde Mountains, east of Tucson, limekilns were built, and the immediate vicinity, now the general location of Saguaro National Monument, was denuded of trees as fuel for burning the limestone.

In the 1870's and 1880's, cattle increased to such an extent that there was serious overgrazing of the range around Tucson. Vegetation left by the woodcutters was browsed and trampled. Hillsides were stripped of their protective plant growth, allowing the thin layer of duff and humus to be washed away. Coyotes found veal palatable, and the cattlemen declared unremitting warfare upon them. With the *de*crease of coyotes, there was a corresponding *in*crease in the population of their natural prey, the ground squirrels, rabbits, kangaroo rats, and other desert rodents. The remaining vegetation on which these rodents fed naturally suffered.

And so, as the years passed and the individual saguaros making up the great Cactus Forest along the base of the Tanque Verdes east of Tucson grew older and more vulnerable, a gradual change was taking place. Few noticed, but no longer were there any young saguaros hidden beneath the occasional tree that still remained. Woodcutters had stripped the area of mesquites and ironwoods, whose low-hanging branches were so essential to the protection of saguaro seedlings. Half-starved cattle wore trails across the hillsides and trampled new growths into the gravelly soil. Rodents, released from their coyote enemies, multiplied amazingly, ate everything that was moist or green, and gnawed the bark from shrubs and brush. Hardly a single infant saguaro survived. In half a century, Nature's balance had been upset, and reproduction of saguaros in the Cactus Forest east of Tucson had practically ceased.

The warning almost imperceptible

Yet, to the casual observer, all seemed serene and unchanged. The widespread forest of gray-green saguaros lifted fluted arms high into the golden sunshine, and each spring their creamy tiaras of flowers gleamed like the silver crowns of a million queens of the May. More and more people from the East and North learned of the delightful winter climate of southern Arizona and came to Tucson to see, among other attractions, the famous forest of giant cacti. And so, in 1933 Saguaro National Monument was established—a scientific marvel to be protected and preserved for the benefit and enjoyment of the people of the United States.

Both the Federal Government and the University of Arizona were then interested in the Cactus Forest and the many manifestations of desert biology presented there, but it was not until 1938 that the lack of young, small saguaros received attention. A tentative study was started by Carleton and Judith Wilder to determine if reproduction actually was subnormal and if so why. No great importance was attached to the findings. It took a serious outbreak of the bacterial disease to start a series of studies that, although not yet completed, have brought to light the chain of events described here. This disease is the only cause of death among saguaros, so far as is known, except for an occasional wind-thrown individual.

During the summer of 1939, Dr. J. G. Brown of the University of Arizona noticed that many of the older and larger saguaros around Tuscon were infected with a type of rot. In Saguaro National Monument, because of the preponderance of mature individuals, the disease reached epidemic proportions. Great sores appeared in the branches and trunks of the desert Mammoths, exuding a black, syrupy fluid that dribbled down the trunks and formed tarry pools on the ground. The plants literally melted away and died, leaving only their polelike skeletons and big patches of parchment-like skin.

Through exhaustive tests, Dr. Brown and his students determined that the cause of the disease was a bacterium, *Erwinia carnegieana*, and the situation was reported the following year to the United States Department of Agriculture. During 1941 and 1942, the Bureau of Plant Industry, Soils, and Agricultural Engineering sent Dr. Lake S. Gill and Mr. Paul Lightle to set up study plots in the Cactus Forest and to carry out extensive investigations. Remedial measures necessitated the destruction of 335 seriously infected plants.

Continued studies by Dr. Brown of the University and by Drs. Lee M. Hutchins and James L. Mielke of the Bureau have since uncovered a number of pertinent facts. These investigations are still under way and no conclusive statements can be issued until the work has been completed. However, according to a recent unpublished report by Dr. Mielke, some of the findings are so strongly supported by accumulated evidence that the following statements seem to be well established.

Apparently this disease, or necrosis, has for centuries been the principal cause of death of saguaros. It is generally fatal only to mature plants. Younger plants become infected, but the lesions callous over and the plants usually recover, except for an occasional individual.

The bacterium causing the disease is carried within the intestine of the larvae of a small, night-flying moth, *Cactobrosis fernaldialis*, the David to which the saguaro plays Goliath. The larvae live only in fresh, pulpy saguaro tissue and gnaw tunnels indiscriminately through the flesh upon which they feed. It is along these tunnels that the bacterial infection makes its appearance. The rot has not yet been found in association with any injury of the saguaros other than the tunnels made by the moth larvae, except in the case of one lightning-struck plant.

There are some interesting sidelights. For example, two or more species of drone flies breed in the rot pockets in the decaying saguaro pulp. Woodpeckers, particularly the Gila woodpecker and the Gilded Flicker feed on the larvae of the drone flies. Probing in search of them, the birds open the rot pockets and clear out some of the decayed material. Apparently about 50% of the lesions thus opened, even in old plants, callous over and heal. Thus the woodpeckers become an important aid to saguaros in effecting self-recovery.

Taking a lesson from the woodpecker, technicians of the Bureau of Plant Industry, by opening and draining rot lesions, found they were able to save many infected saguaros. However, since the infection starts along the larvae tunnels deep within the tissues of the plant, the disease frequently destroys so much tissue before there is visible evidence that control measures are impractical. It has not been found possible by any means yet developed to prevent the death of a certain proportion of infected plants each year. So, like an army surrounded by the enemy and without hope of reinforcements, it appears to be just a matter of time until the famous Cactus Forest of Saguaro National Monument will gradually go down under the persistent efforts of the bacterium and its moth-larvae carrier.

Can extinction be prevented?

The pioneer woodcutters, their cattle, and the coyote hunters of old Tucson, with the help of the larvae of this moth, seem to have set the stage for the destruction of the Cactus Forest. But is it not still possible for us to step in on the side of Mother Nature and counteract the damage that was unwittingly started by the pioneers back in the 1880's? Can we not fence out the cattle, poison the rodents, encourage the ironwoods and mesquites to re-establish themselves, and in so doing restore conditions favorable to a new generation of saguaros? It may not be reasonable to expect the cowmen owning or leasing large blocks of land in the Cactus Forest portion of Saguaro National Monument to remove their cattle and turn over their range to cactus and coyotes. But many will say that it is sad indeed if a great country like ours, in which the expenditure of a billion dollars scarcely makes a newspaper item, cannot buy out these private lands, which have such relatively trifling economic worth. The unfortunate cattle, probably dozens or hundreds, certainly not thousands,

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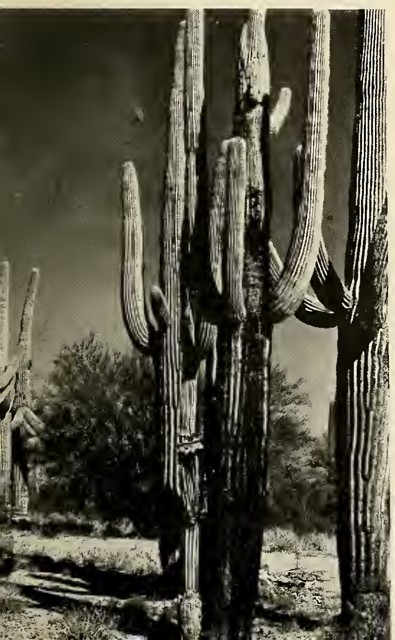
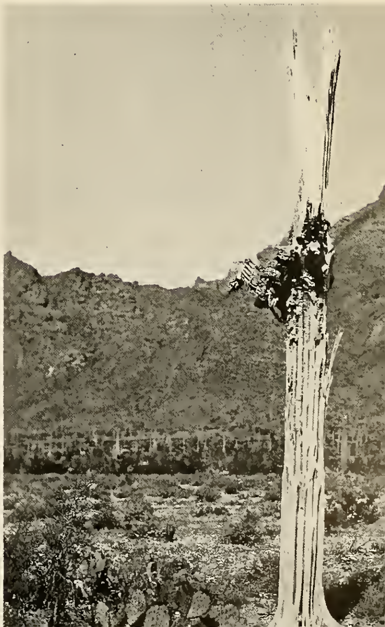
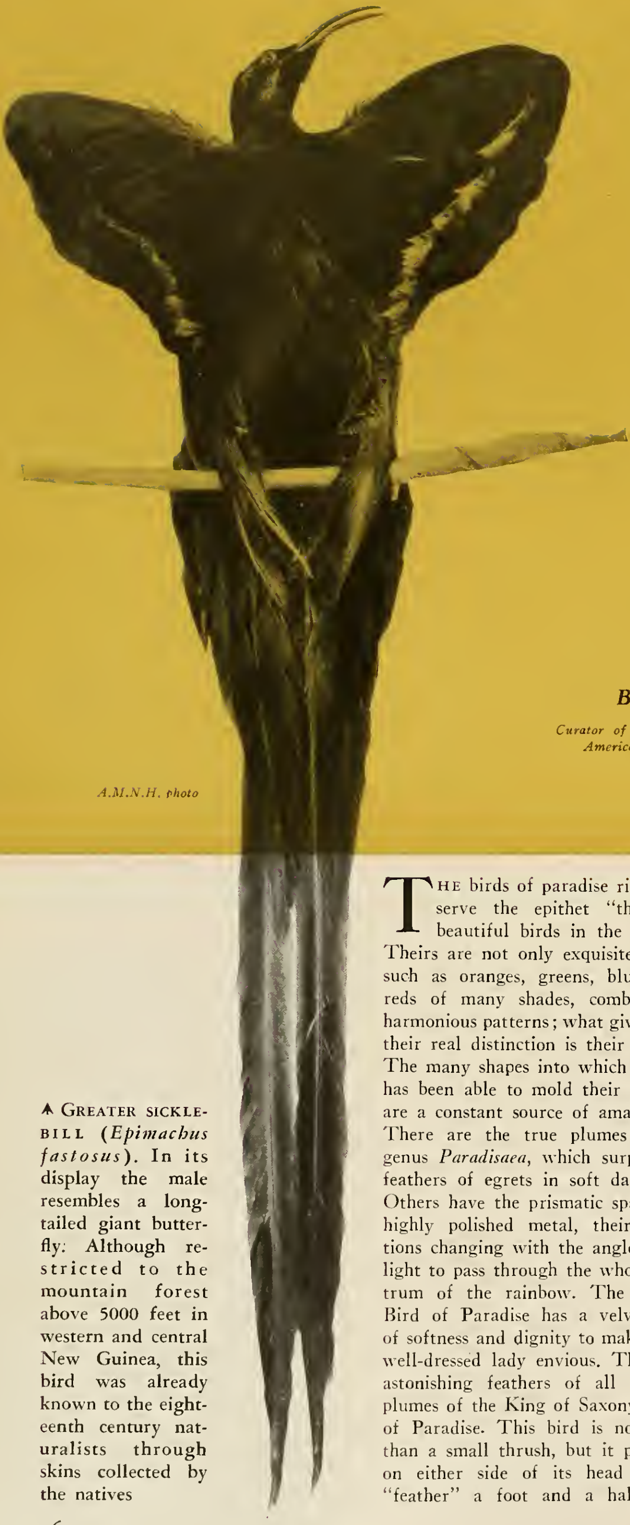


< **This saguaro** is seriously infected with the disease and is literally melting away. Note the big lesion on the trunk just above and between the branches. Moisture stored in the great plant flows from the open sore in sticky, tarlike rivulets



> **Only the skeleton** bleaching in the desert sun: a desert giant that recently became a victim of the disease



A.M.N.H. photo

Deep in the jungle's forbidding wilderness, these magnificent creatures enact a drama of enchanting beauty. Centuries of search have revealed their secrets, and now the finest existing collection enables the American Museum to offer the public a spectacular new exhibit

Birds of

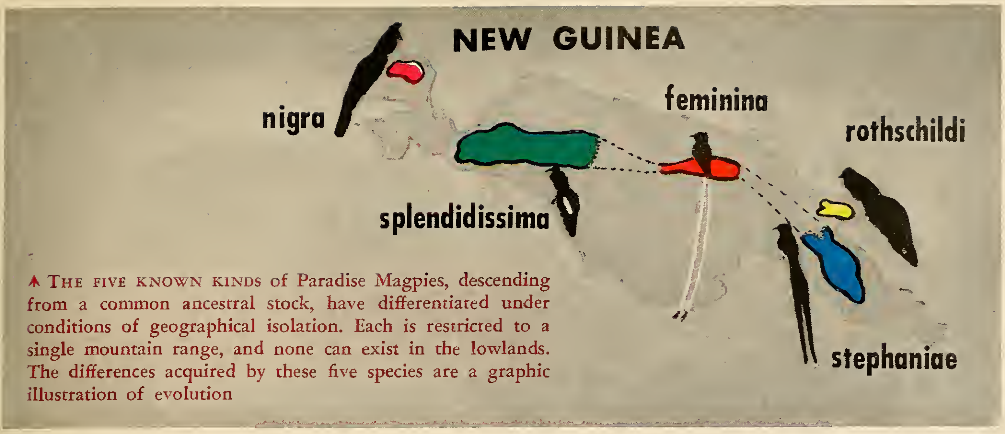
By Ernst Mayr

Curator of the Whitney-Rothschild Collections,
American Museum of Natural History

▲ Greater sicklebill (*Epimachus fastosus*). In its display the male resembles a long-tailed giant butterfly. Although restricted to the mountain forest above 5000 feet in western and central New Guinea, this bird was already known to the eighteenth century naturalists through skins collected by the natives

The birds of paradise richly deserve the epithet "the most beautiful birds in the world." Theirs are not only exquisite colors, such as oranges, greens, blues, and reds of many shades, combined in harmonious patterns; what gives them their real distinction is their plumes. The many shapes into which Nature has been able to mold their feathers are a constant source of amazement. There are the true plumes of the genus *Paradisaea*, which surpass the feathers of egrets in soft daintiness. Others have the prismatic sparkle of highly polished metal, their reflections changing with the angle of the light to pass through the whole spectrum of the rainbow. The Superb Bird of Paradise has a velvet cape of softness and dignity to make every well-dressed lady envious. The most astonishing feathers of all are the plumes of the King of Saxony's Bird of Paradise. This bird is no larger than a small thrush, but it produces on either side of its head a thin "feather" a foot and a half long, whose simple wirelike shaft is bedecked on one side with two-score little horny plates like silvery-blue flags.

So extraordinary is the plumage of these birds, which are found nowhere outside the New Guinea area, that some were known to Oriental traders and seafarers centuries before the actual discovery of their native home. As a result, some fantastic ideas grew up about the birds. The first skins to reach Europe were brought by El Cano who, after the death of Magellan, took over the command of the first circumnavigation of the globe. At the small Moluccan Island of Tidore, the Rajah of Batjan presented him with several bird of paradise skins, which reached Spain on September 6, 1522. These skins had been prepared by New Guinea natives in the customary way by taking out the body, cutting off the legs, and drying the skin over a fire. The curious legless skins with the beautiful long plumes led to some amusing stories. Girolamo Cardano, for ex-



▲ The five known kinds of Paradise Magpies, descending from a common ancestral stock, have differentiated under conditions of geographical isolation. Each is restricted to a single mountain range, and none can exist in the lowlands. The differences acquired by these five species are a graphic illustration of evolution

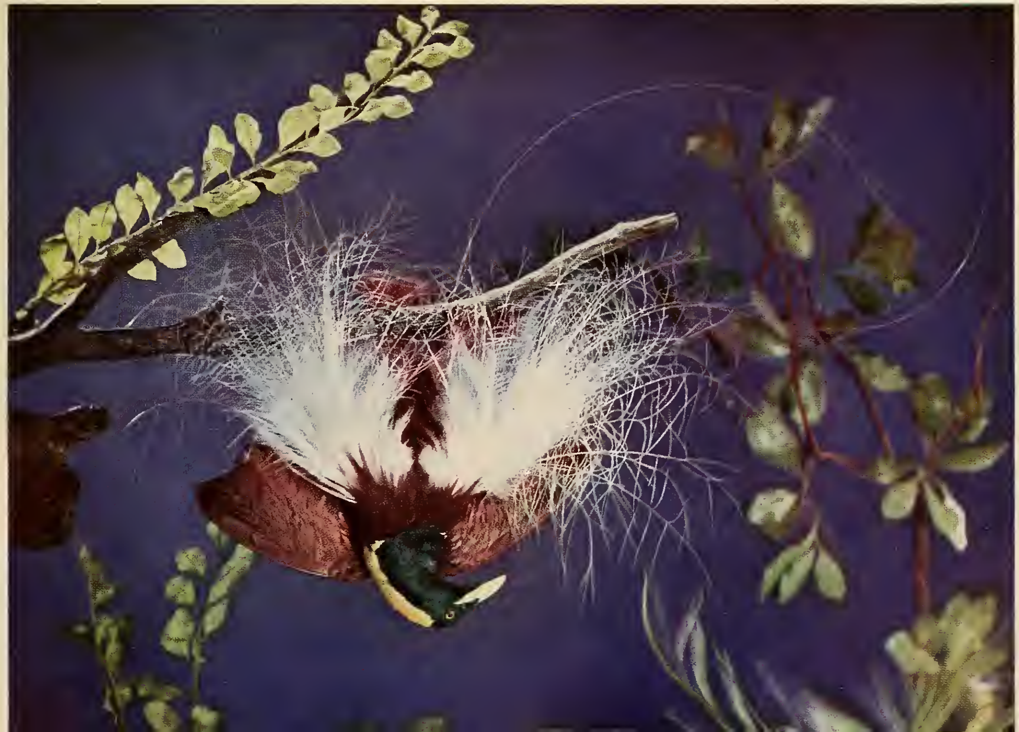
Paradise

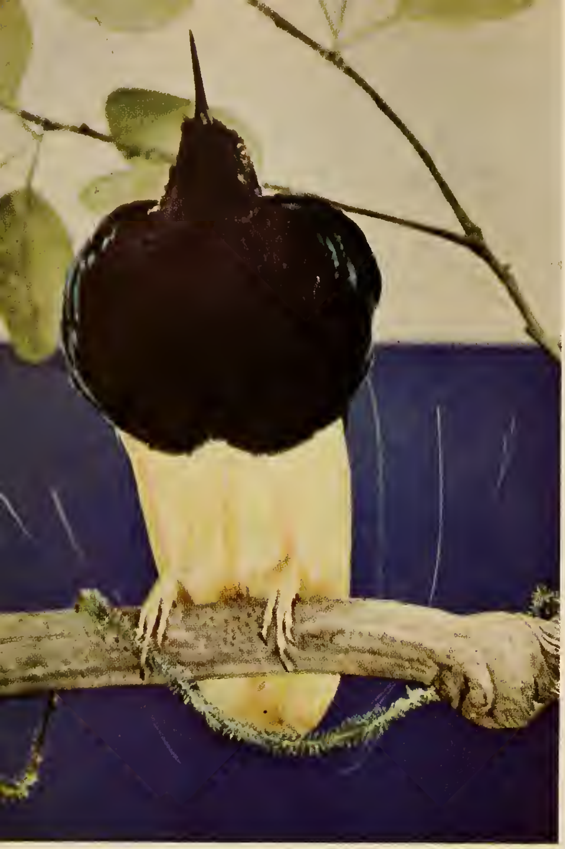
ample, wrote in 1551: "The 'Birds of the Gods' come from the Moluccas where they are picked up dead on land or in the sea. They are never seen alive. Since they lack feet, they are obliged to fly continuously and live therefore in the highest sky far above the range of human vision . . . the back of the male is hollowed out and the female lays her eggs into this cavity and incubates them while the male continues flying . . . they require no other food or drink than dew from Heaven." The name Bird of Paradise was given them in the belief that Paradise was their true home.

At this time their plumes were already in use as customary ornaments by the Janizaries of the court of the Sultan of Turkey, as reported by Belon (1546-1549). The first (and very inadequate) illustration of a bird of paradise was published by the Swiss naturalist Gesner in 1555. All these early reports seem to refer to the Greater Bird of Paradise (*Paradisaea apoda*). In 1605, Charles L'Ecluse was already able to give a short but accurate description of three

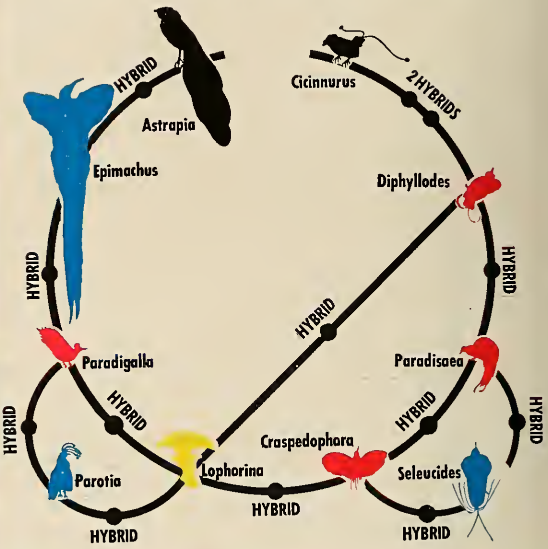
▼ Emperor William's bird of paradise (*Paradisaea guilielmi*). At the climax of its courtship display, the male hangs upside down

A.M.N.H. Kodachrome





▼ Ten of the 20 genera of birds of paradise are known to cross and produce hybrids, as shown by this diagram. Two of these (in black) cross with species of only one other genus. Three of them (in blue) cross with two. Four of them (red) cross with three. The Superb Bird of Paradise (yellow) is known to produce hybrids with four other genera. (The colors are represented arbitrarily)


HYBRID
Astrapia
Cicinnurus
2 HYBRIDS
Epimachus
Diphyllodes
HYBRID
HYBRID
HYBRID
Paradigalla
Paradisaea
HYBRID
HYBRID
HYBRID
Craspedophora
HYBRID
Parotia
Lophorina
Seleucides
HYBRID
HYBRID
HYBRID

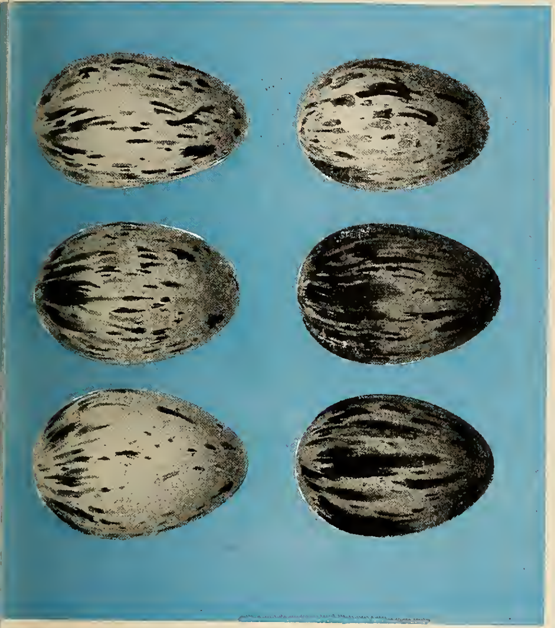
▲ Swampy lowland forests, particularly with sago palms, are the favorite haunt of the Twelve-wired Bird of Paradise. When exposed to the sun, the delicate orange of the plumes bleaches to white. The female is plain: brown and black above, barred buff and brown below

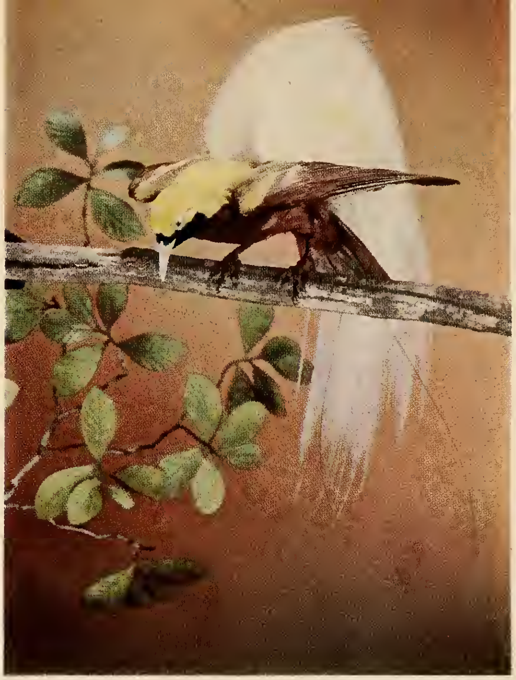
A.M.N.H. photos

➤ A new museum exhibit of "rifle birds," as the black birds of paradise, with velvety and iridescent colors, are sometimes called. As if to make up for the simplicity of their black dress, these birds have developed some of the most bizarre ornamental plumes known among birds

Bird of paradise eggs are mostly orange streaked with brown. hose of six different species are reproduced here in actual size. At wer left is the Twelve-wired Bird of Paradise. Right upper and nter are the Australian Rifle Bird and the Paradise Magpie respecely. The other three are Plume Birds. (Actual size.)

After Ernst Hartert, in Novitates Zoologicae

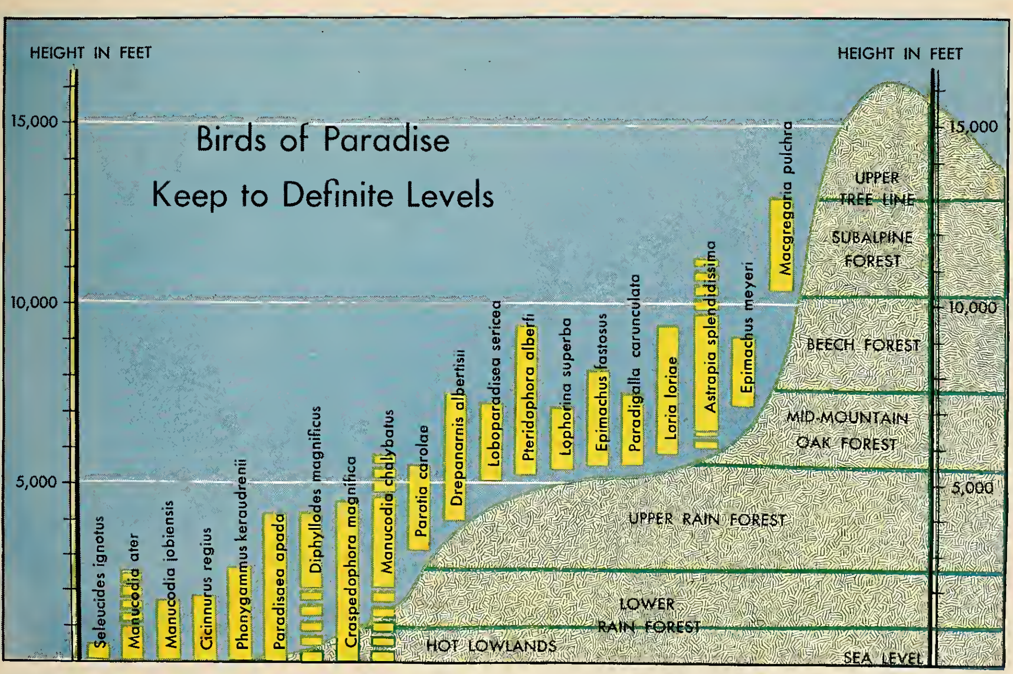


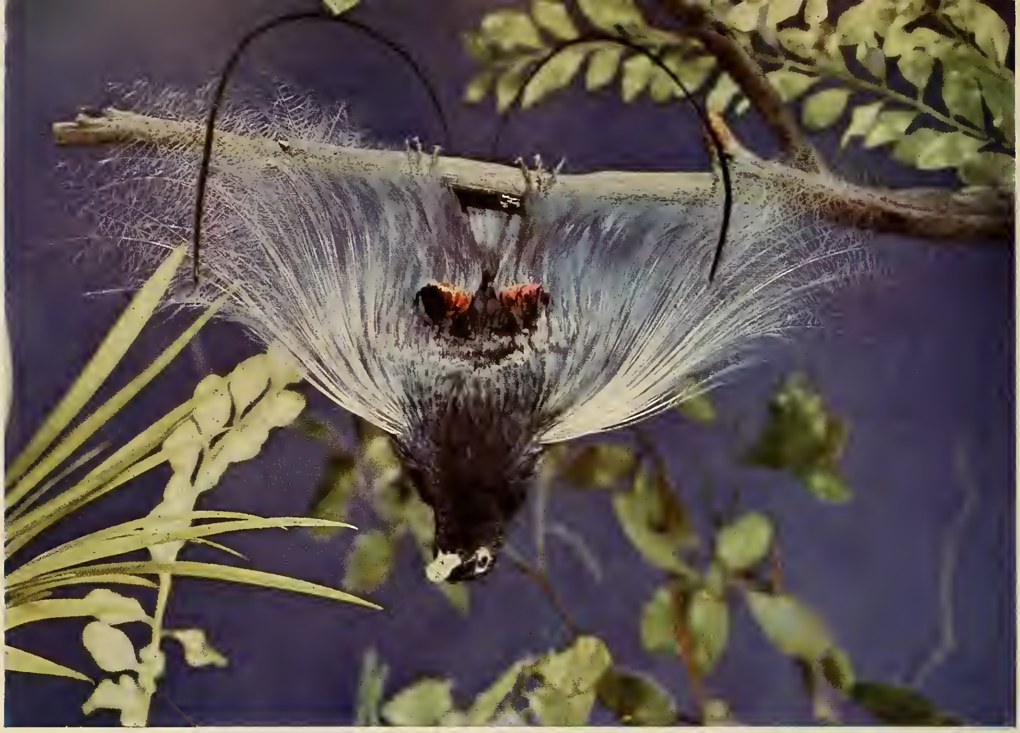


A.M.N.H. Kodachrome

▲ **The lesser bird of paradise** (*Paradisaea minor*) was one of the most important "plumed birds" of the feather trade. Countless thousands were killed annually early in this century to adorn ladies' hats. Groups of males have "dancing parties" in a favorite tree where they display their plumage in an effort to win the favor of visiting females

▼ **Birds of paradise** are restricted to definite elevations like all animals. The chart below shows the ranges of 20 species in relation to the zones of vegetation on the slope of the Snow Mountains in South New Guinea





A.M.N.H. Kodachrome

▲ THE BLUE BIRD OF PARADISE (*Paradisaea rudolphi*) is named in honor of the ill-fated Archduke Rudolph of Austria. It is found only in the mountains of southeast New Guinea. In its upside-down display it spreads its delicate blue plumes fanlike

species, but François Valentyn (1726) was the first to describe in detail the plumage, habits, and distribution of six species. Since then, the exploration for birds of paradise has made rapid progress. A new species was discovered in the interior of New Guinea as recently as 1938.

The thrill of the search for birds of paradise was conveyed by the celebrated naturalist Alfred Russel Wallace, writing from Aru almost one hundred years ago: "The first two or three days of our stay here were very wet, and I obtained but few insects or birds, but at length, when I was beginning to despair, my boy Baderoon returned one day with a specimen which repaid me for months of delay and expectation. It was a small bird, a little less than a thrush. The greater part of its plumage was of an intense cinnabar red with a gloss as of spun glass. On the head the feathers became short and velvety and shaded into rich orange. Beneath, from the breast downwards, was pure white, with the softness and gloss of silk, and across the breast a band of deep metallic green separated this color from the red of the throat. Above each eye was a round spot of the same metallic green; the bill was yellow, and the feet and legs were of a fine cobalt blue. . . . Springing from each side of the breast, and ordinarily lying concealed under the wing, were little tufts of grayish feathers about two inches long and each terminated by a broad band of intense emerald green. These plumes can be raised at the will of the bird and spread out into a pair of elegant fans when the wings are elevated. But this is not the only ornament. The middle feathers of the tail are in the form of slender wires about five inches long, which diverge in a beautiful double curve. About half an inch of the end of this wire is webbed on the outer side only and colored of a fine metallic green and, being curled spirally inward, form a pair of elegant glittering buttons, hanging five inches below the body and the same distance apart. These two ornaments, the breast fans and the spirally tipped tail wires, are altogether unique, not occurring on any other species of the 8000 different birds that are known to exist upon the earth. . . . My transports of admiration and delight quite amused my Aru hosts who saw nothing more in the "Burong rajah" than we do in the robin or the goldfinch.

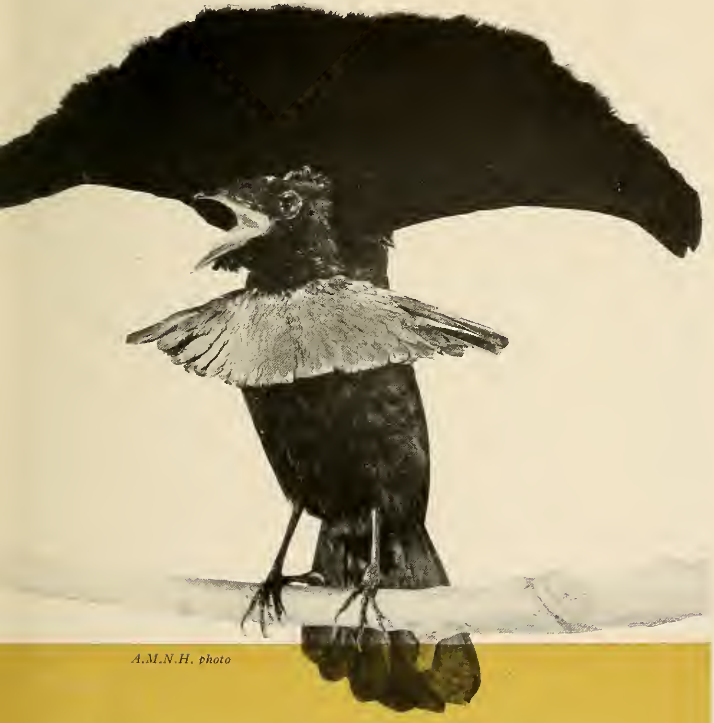
"Thus one of my objects in coming to the Far East was accomplished. I had obtained a specimen of the King Bird of Paradise (*Paradisea* [*Cicinnurus*] *regia*), which has been described by Linnaeus from skins preserved in a mutilated state by the natives. . . . The emotions excited in the mind of a naturalist, who has long desired to see the actual thing which he has hitherto known only by description, drawings, or badly-preserved external covering—especially when that thing is of surpassing rarity and beauty—require the poetic faculty fully to express them. The remote island in which I found myself situated, in an almost unvisited sea, far from the tracks of merchant fleets and navies; the wild, luxurious tropical forest, which stretched far away on every side; the rude, uncultured savages that gathered round me—all had their influence in determining the emotions with which I gazed upon this "thing of beauty." I thought of the long ages of the past, during which the successive generations of this little creature had run their course—year by year being born and living and dying amid these dark and gloomy woods, with no intelligent eye to gaze upon their loveliness; to all appearance such a wanton waste of beauty. Such ideas excite a feeling of melancholy. It seems sad that on the one hand such exquisite creatures should live out their lives and exhibit their charms only in these wild, inhospitable regions, doomed for ages yet to come to hopeless barbarism; while on the other hand should civilized man ever reach these distant lands and bring moral, intellectual, and physical light into the recesses of these virgin forests, we may be sure that he will soon disturb the nicely-balanced relations of organic and inorganic nature as to cause the disappearance and finally the extinction of these very beings whose wonderful structure and beauty he alone is fitted to appreciate and enjoy. This consideration must surely tell us that all living things are *not* made for man. Many of them have no relation to him. The cycle of their existence has gone on independently of his and is disturbed or broken by every advance in man's intellectual development; and their happiness and enjoyments, their loves and hates, their struggles for existence, their vigorous life and early death, would seem to be immediately related to their own well-being and perpetuation alone, limited only by the equal well-being and perpetuation of the numberless other organisms with which each is more or less intimately connected."

The writer is often asked by would-be young explorers what chances there are for the discovery of new birds of paradise. Crystal gazing is not my profession, and the only answer I can give to such a question is based on an estimate of probabilities. Since 1910, only one good species of bird of paradise has been discovered, and even that is a geographical representative of three other mountain species that had long been known. I would judge, therefore, that the chances are exceedingly slight. However, it is a virtual certainty that unknown *races* will be discovered in the unexplored mountains in the interior of New Guinea. As late as 1929, I discovered a new race of the little Golden Silky Bird of Paradise (*Loboparadisea*) in the Herzog Mountains, near Lae of recent battle fame, a species previously known only from the Snow Mountains of Netherlands New Guinea.

The most striking discovery of recent years was the male of the Ribbon-tailed Paradise-Magpie in 1938, of which the inconspicuous-looking female had been known already for 25 years. This magnificent bird has two extremely long silky-white central tail feathers with black tips. The rest of the plumage is black and dark green, the glossy parts sparkling in all the colors of the spectrum. It is not surprising that this bird has escaped discovery so long, because its range lies in the most inaccessible part of central New Guinea, in the mountains between the headwaters of the Fly and Sepik Rivers. While most or all of the species are known, so little is known about their habits and life history that any student is sure to make his share of discoveries. There are at least ten species whose habits are still completely unknown.

Elusive birds of paradise

One reason why Lord Rothschild asked me, in 1927, to go to New Guinea was to search for the so-called "rare birds of paradise." This term has a special meaning. In the days when the plume trade was flourishing, tens of thousands of bird of paradise skins went every year through the hands of the great plume dealers in the Indies, Paris, Amsterdam, and London. These dealers, among whom the Dutchman Duivenbode and the French dealer Mantou were best known, discovered each year in their shipments from New Guinea a few skins that did not seem to belong to any known species. Lord Rothschild and other collectors were willing to pay fabulous prices for



A.M.N.H. photo

▲ **The superb bird of paradise (*Lophorina superba*) has two sets of plumes. One is a breast shield of a glossy green; the other is a cape of velvety black feathers which can be raised over the head. The inside of the mouth is brilliant yellow and is displayed prominently against the background of the raised black cape** these specimens, which they subsequently described as new species. In later years, it was discovered that some of these skins had come by devious channels from inaccessible mountains in remote parts of New Guinea. More than a dozen of these species, however, defied all the efforts of even the most resourceful hunters. Lord Rothschild did not give up hope, however, and when he sent me to New Guinea it was in the expectation that the home of these rare species would eventually be discovered. I was to make a thorough survey of a number of isolated mountain ranges in that region.

I had a most successful expedition in every way except with respect to Lord Rothschild's pet project. I did not rediscover a single one of the rare birds of paradise. My failure to do so, however, was indirectly responsible for the eventual solution of the puzzle. It set Professor Stresemann of the University of Berlin on the track of these birds, and by a careful study of the museum specimens he came to the conclusion that all the fifteen rare birds of paradise, whose homes could not be discovered, were actually hybrids of well-known species. This conclusion is now universally accepted.

Frequency of crossing

The question has often been asked why hybrids are so common among birds of paradise. But are they really common? If one or two such hybrids were culled out of an annual crop of 30,000 to 50,000 plumes, it would mean that only one out of 20,000 birds is a hybrid. This is certainly not a very high ratio. Even so, there is reason to believe that it is higher than among most other birds. The reason is obvious as soon as we recall the breeding habits of these birds. The nestling female bird never sees her father, and her younger brothers as well as her mother are of a simple coloration, totally unlike that of the adult male. The mature female is attracted to the display ground when she is ready for mating and leaves the male soon after. It is only to be expected that she will accept a mate of another species oftener than will females of species in which the members of a pair live together for days, weeks, or months before the actual start of reproduction.

The American Museum's collection of birds of paradise was very meager until about twenty years ago. Dr. Leonard C. Sanford, generous trustee of the Museum, who has done so much to build the Bird Department, was fully aware of this deficiency. In 1928, he sent Rollo H. Beck to northeast New Guinea and the writer to Dutch New Guinea to fill some of the gaps, and in 1929 they were followed by the Whitney South Sea Expedition, sponsored by Harry Payne Whitney, which concentrated on British Papua.

The result of these efforts was the finest collection of birds of paradise to be found in America but, alas, still a very poor second to the famous collection in the private museum of Lord Rothschild in England. This collection, resulting from 40 years of concentrated effort, contained nearly every known kind of bird of paradise, including about seventeen that were for the first time described by Lord Rothschild himself. Furthermore, this collection was of inestimable scientific value, because it contained large numbers of young, female and male birds in various stages of molt, giving a complete picture of variation and evolution in this wonderful group.

It seemed utterly beyond our fondest hope that the American Museum should ever come into possession of such a magnificent collection. It was therefore an overwhelming surprise when in 1932 Lord Rothschild offered his entire collection for sale and Mrs. Harry Payne Whitney seized the opportunity to donate it to the American Museum. It gives this institution by far the finest representation of birds of paradise existing in the world. It has since been augmented through the explorations of Richard Archbold and his associates.

Although primarily a research collection, the Museum has long felt that visitors would appreciate a public exhibit of birds of paradise, presenting the latest information on the remarkable displays of these birds. Through the interest and generosity of Colonel C. V. Whitney, it has been possible to carry out plans for such an exhibit, originally conceived by Dr. Sanford. Most of the illustrations on the accompanying pages are based on photographs of these new exhibits in Whitney Memorial Hall at the American Museum of Natural History.

Birds of paradise are believed to be resplendent relatives of the crow family. Indeed, the most primitive birds of paradise, the four species of manucodes, look very much like small crows, except that the plumage has a more pronounced purplish or bluish sheen. Males and females in this group are colored alike, although the males are slightly larger. Most persons would hardly believe that these plain birds are birds of paradise. Yet they are connected with the more bizarre types by an unbroken series of intermediate forms.

Recent students recognize 39 species and 59 subspecies of birds of paradise, grouped in twenty genera. The ornithologists of the nineteenth century had the habit of naming newly discovered birds of paradise for the crowned heads of Europe, to honor them and perhaps to please them sufficiently for a raise in the annual appropriation for their respective museums. This custom displeased the French ornithologist Charles Louis Bonaparte, nephew of Napoleon. When he finally had a chance to name a newly discovered bird, he called it "A Republican Bird of Paradise" with the following amusing explanation:

"Since I for my person have not the slightest regard for the sovereignty of all the princes in the world, I have adorned the most exquisite bird of paradise with the name of the Republic: that Republic which would be Paradise, if it had not been turned into Hell by evil tricks and through the ambition of so-called Republicans unworthy of the name they claimed for themselves. . . . However, even though a paradisean Republic does not exist, at least there is now a *Paradisea respublica* (a Republican Bird of Paradise)."

Unfortunately there are no good English names for about eleven of the groups in which the known 39 species may be divided. The brightly colored ones are sometimes referred to as "plume birds," and the black ones with metallic feathers as "rifle birds," but this classification of convenience oversimplifies matters. A diagram reproduced on page 274 shows the family tree of the birds of paradise and divides them into a few convenient groups.

No less bizarre than the plumes of the birds of paradise are their courtship habits. To be sure, there are a few species that live a very conventional and proper family life. It is more than a coincidence that these same species lack the extraordinary plumes and color. The manucodes are black with a greenish blue or purple gloss. Both mates co-operate in the building of the nest and in raising the young. If these birds behave like their close relatives, the crows, it will be found that the female alone incubates the eggs. No observations on this point are yet available. The males, however, have one very extraordinary feature: their trachea, or windpipe, is more than twice the normal length and is coiled up in a big loop on top of the breast bone.

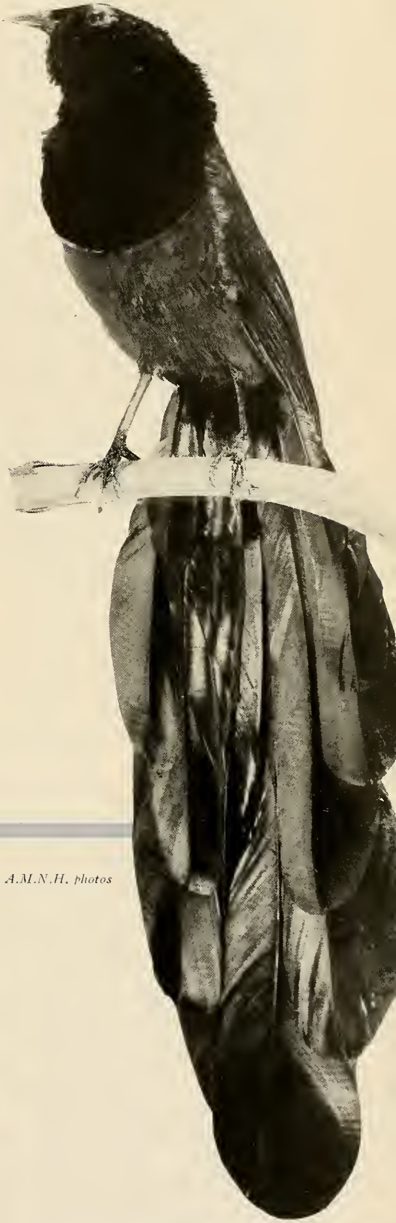
Recent observations by Dr. Rand indicate that in Macgregor's Bird of Paradise the male also participates in the raising of the young. In all other species, so far as we know, the female is alone and completely responsible for the cares of nest building, incubation, and feeding the young. The males devote their entire existence to feeding and courtship. No wonder they have enough surplus energy to develop their famous plumes as well as to engage in all sorts of odd performances.

It is by no means easy to observe birds of paradise in the wild. Their complicated display poses, therefore, have first been described chiefly from zoological garden specimens. Captivity does not seem to interfere with the normal course of their behavior. It seems that a bird in a cage will go through the same motions he would in nature. What the captive specimens do not tell, however, is whether the courtship is solitary or communal.

On the basis of my own observation, I would say that the display of most of these birds is solitary. Exceptions are the true plume birds (*Paradisaea*) and perhaps the flag birds (*Parotia*). Dr. Rand has added to this category Macgregor's Bird of Paradise, whose males engage in communal courtship chases.

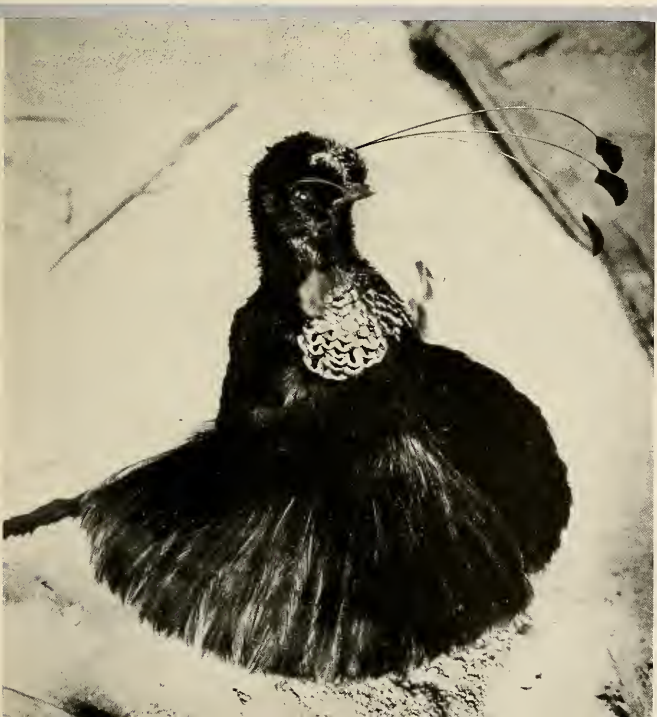
Special "dance floors"

The flag birds, which are limited to the unbroken mountain forests, clear a piece of ground as their "dance floor." There must be a number of low horizontal twigs on which the birds strut. Coming on one of these clearings in the forest, I could always tell whether it belonged to a *Parotia* by the presence of these horizontal branches. There is another bird of paradise that lives in much the same surroundings and prepares little clearings on the forest floor. It is the Magnificent Bird of Paradise. However, most of its perches are vertical—numerous small saplings, at least partly stripped of their foliage. The male performs its curious display while climbing up

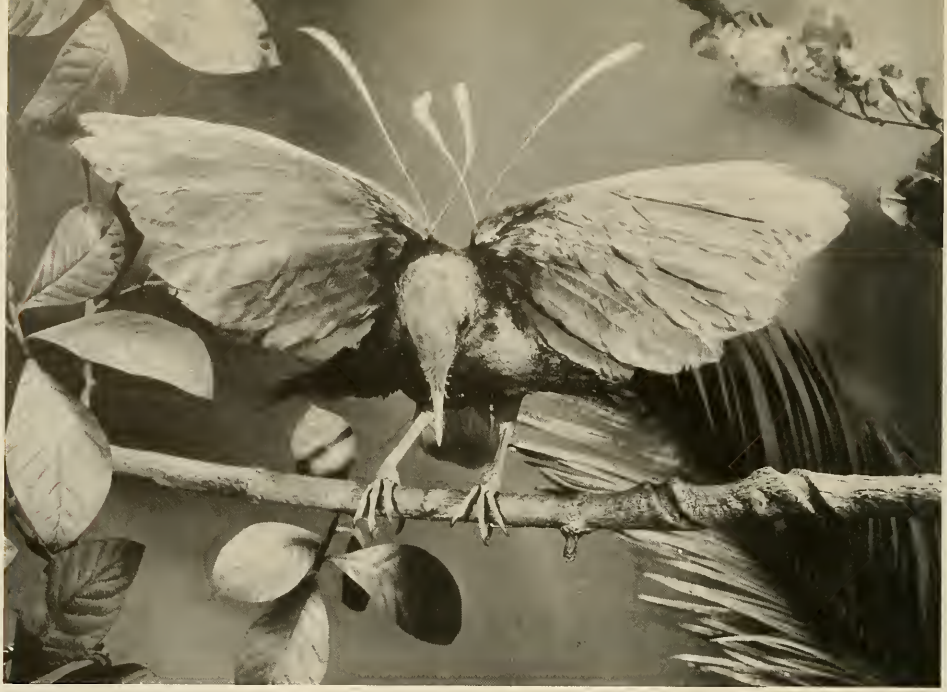


A.M.N.H. photos

▲ THE PARADISE MAGPIE (*Astrapia atra*) leads a solitary life in the mountain forest. It does not indulge in spectacular displays

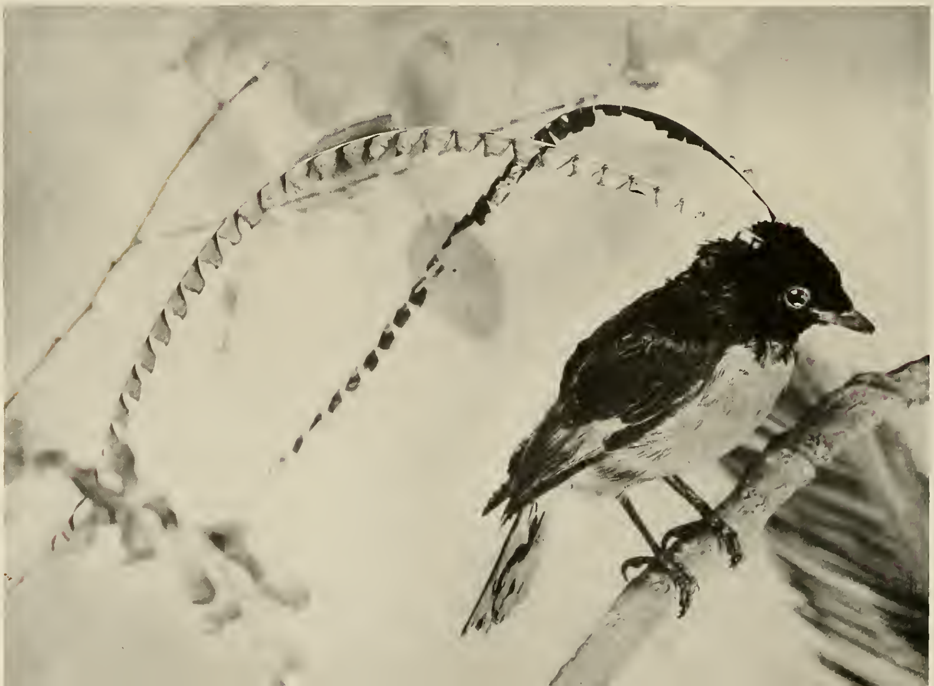


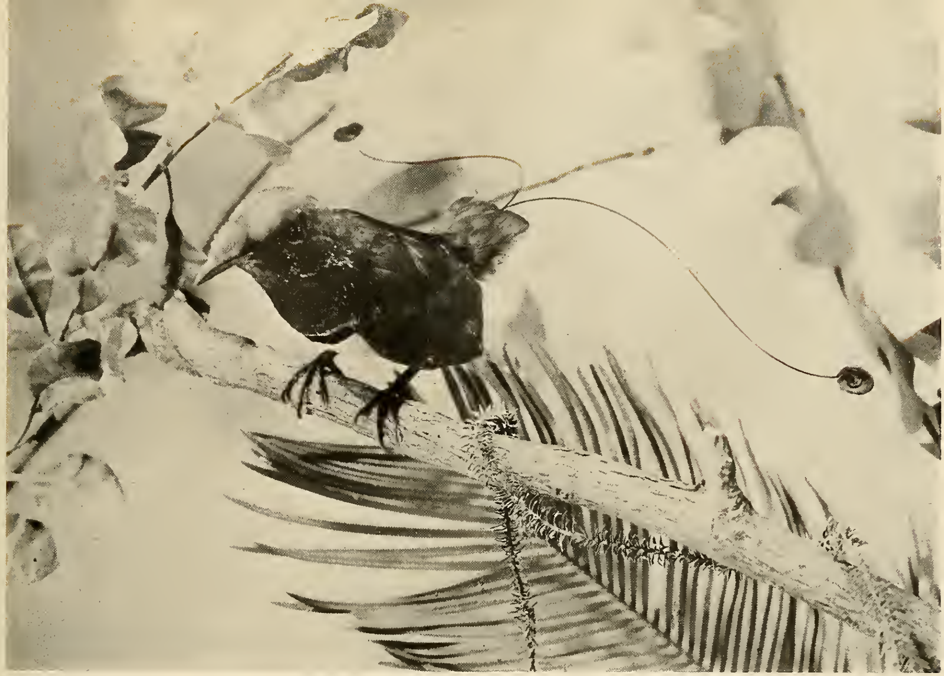
◀ THE LONG-TAILED FLAGBIRD (*Parotia wahnesi*) is restricted to the Huon Peninsula. The Flagbirds are also sometimes called the Six-wired Birds of Paradise



▲ Wallace's standard-wing (*Semioptera wallacei*) lives in the Northern Moluccas. Most of the plumage is pale brown, but the triangular breast shield is brilliant green. The ribbonlike plumes, or "standards," are raised in the display

▼ The plumes of the King-of-Saxony's Bird of Paradise (*Pteridophora alberti*) are considered the most peculiar feathers to be found in the bird kingdom. This is a rare bird of the mountain forest in central New Guinea

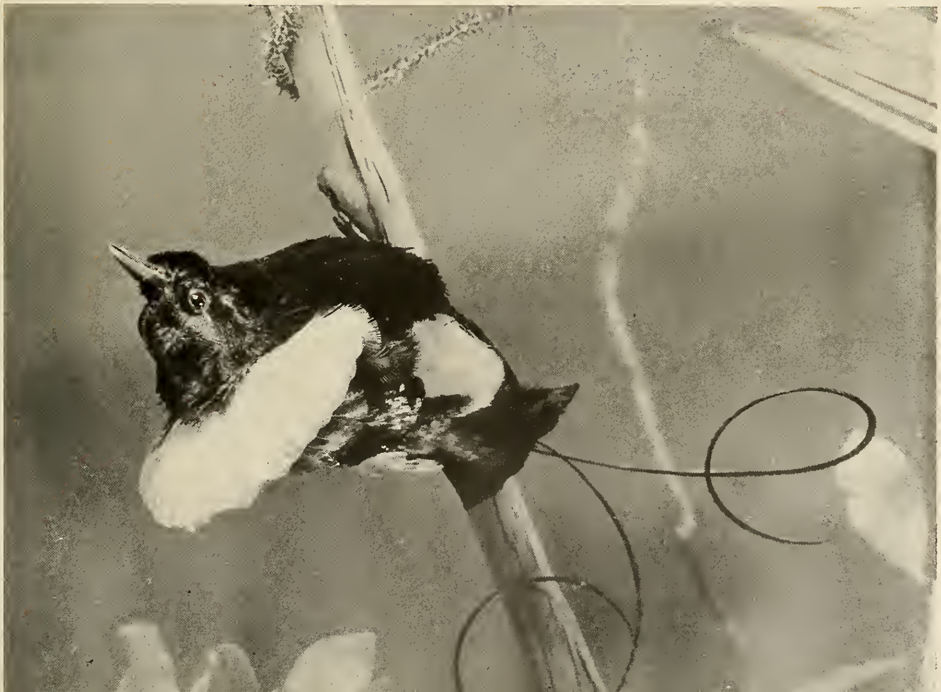




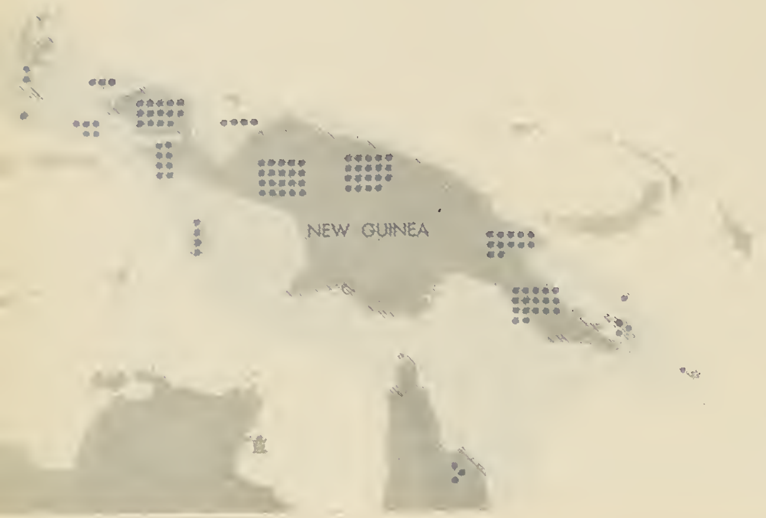
▲ The king bird of paradise (*Cicinnurus regius*) is also called Money-bird because of the coinlike tips on the long wirelike plumes. This is a common bird of the lowland forest

▼ This male of the Magnificent Bird of Paradise displays in an almost upsidedown posture to a female perched above him on the same sapling. Note the raised ruff and the wirelike plumes

A.M.N.H. photos



▼ THE RANGE of the bird of paradise family. Each group of dots indicates how many kinds of birds of paradise might be found in a cross-section as shown at the foot of page 265

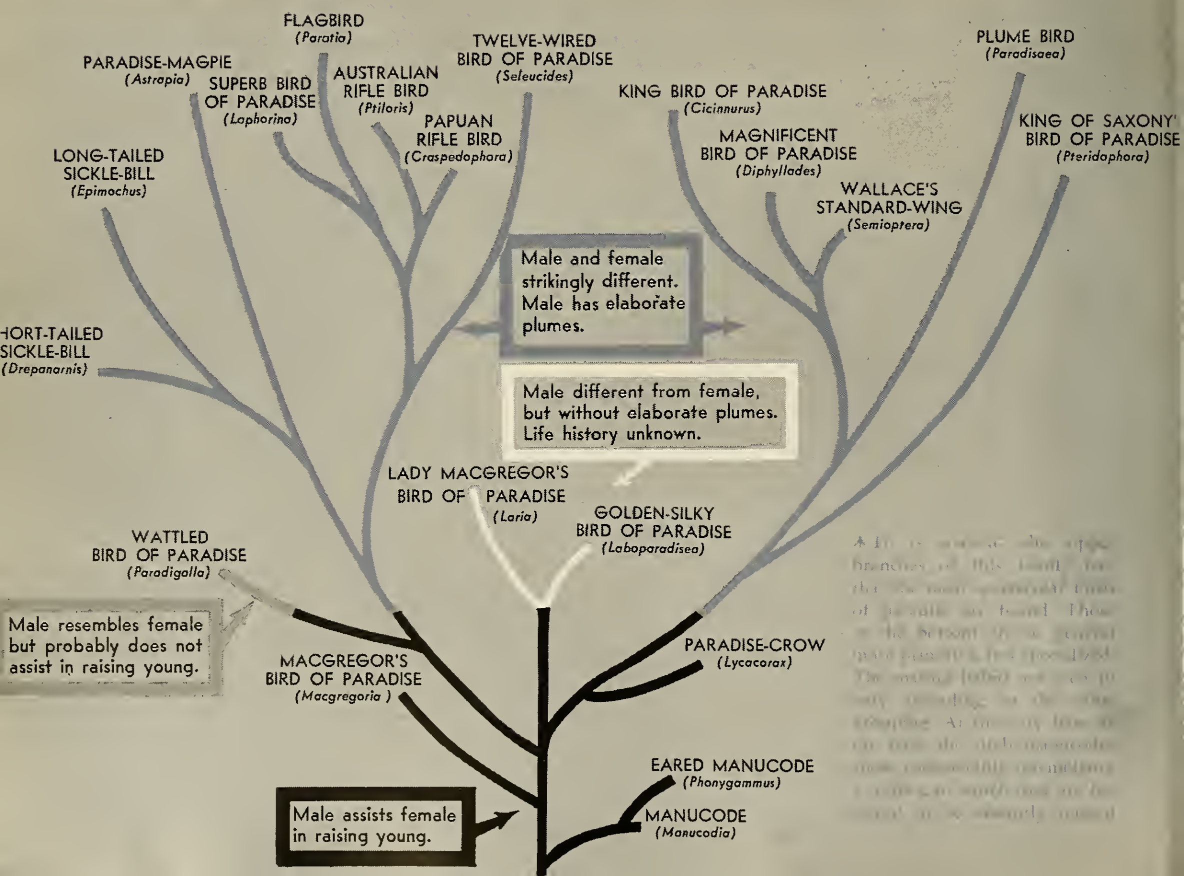


and down these vertical perches. A single male owns each of these display grounds and guards it jealously against any intruder of the same sex, as described by Dr. Rand in NATURAL HISTORY for March, 1940.

These seem to be the only birds of paradise that have regular display grounds. All the others may well have a favored tree or even a perch, but it looks like any other in the forest.

Their future

With heavy fighting going on in New Guinea and with hundreds of thousands of troops stationed along its shores, one may ask whether or not the existence of these birds is threatened. Some apprehension is not unjustified in view of the restricted ranges of the various species. Still, I feel that no danger exists at present and that the birds of paradise will continue to survive and even to flourish, provided no additional danger develops. Two factors, more than anything else, are likely to cause ex-


FLAGBIRD
(Paratia)
PARADISE-MAGPIE
(Astrapia)
SUPERB BIRD OF PARADISE
(Lophorina)
AUSTRALIAN RIFLE BIRD
(Ptiloris)
TWELVE-WIRED BIRD OF PARADISE
(Seleucides)
PAPUAN RIFLE BIRD
(Craspedophora)
LONG-TAILED SICKLE-BILL
(Epimachus)
HORT-TAILED SICKLE-BILL
(Drepanornis)
PLUME BIRD
(Paradisaea)
KING BIRD OF PARADISE
(Cicinnurus)
KING OF SAXONY'
BIRD OF PARADISE
(Pteridophora)
MAGNIFICENT BIRD OF PARADISE
(Diphyllodes)
WALLACE'S STANDARD-WING
(Semioptera)
LADY MACGREGOR'S BIRD OF PARADISE
(Loria)
GOLDEN-SILKY BIRD OF PARADISE
(Loboparadisea)
WATTLED BIRD OF PARADISE
(Paradigalla)
MACGREGOR'S BIRD OF PARADISE
(Macgregoria)
PARADISE-CROW
(Lycocorax)
EARED MANUCODE
(Phonygammus)
MANUCODE
(Manucodia)

Male and female strikingly different. Male has elaborate plumes.

Male different from female, but without elaborate plumes. Life history unknown.

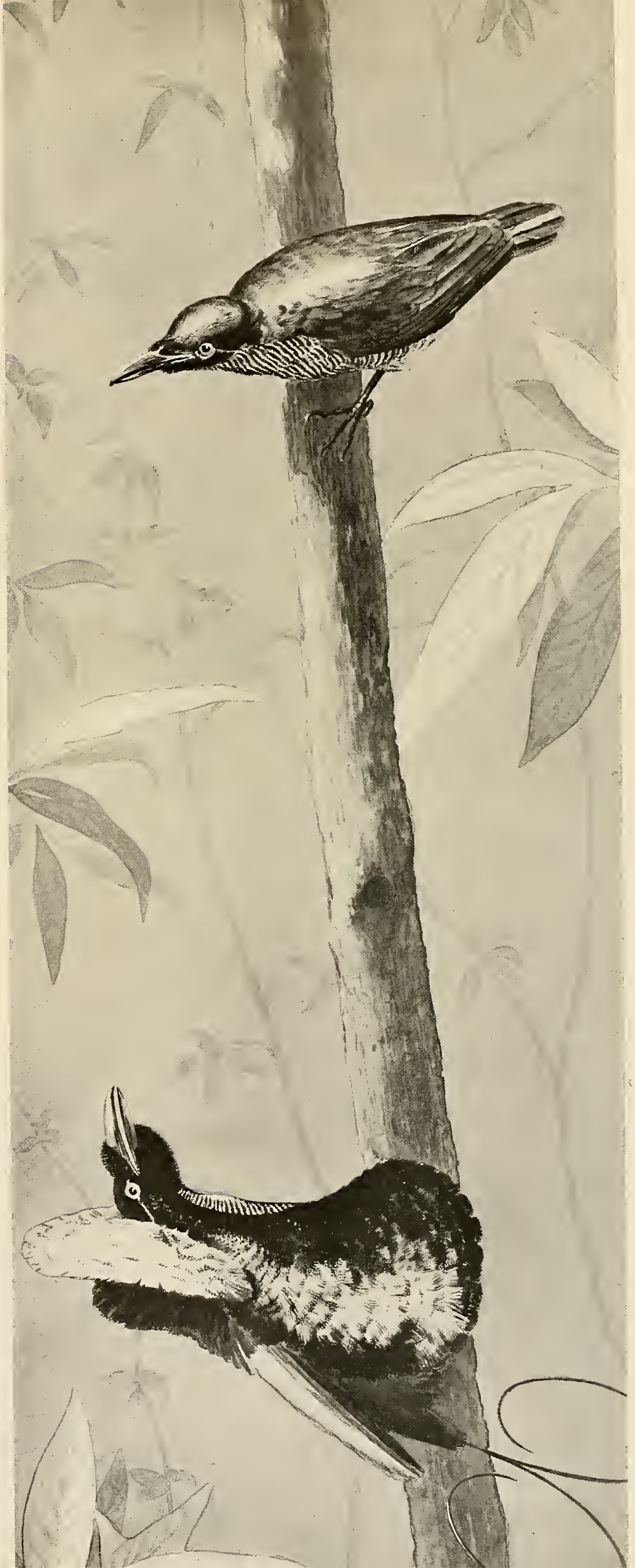
Male resembles female but probably does not assist in raising young.

Male assists female in raising young.

▲ It is among the upper branches of this family tree that the most spectacular birds of paradise are found. Those [illegible] tinction, as shown by the history of birds in New Zealand and Hawaii. One is the destruction of habitat, the other the introduction of alien species. These latter act either as predators, as competitors, or as carriers of diseases and parasites. In view of the vastness of New Guinea forests, the efforts of conservation should be directed principally against voluntary or accidental introduction of alien species.

That even heavy hunting in an undisturbed habitat does not necessarily lead to extinction is well illustrated by the history of the plume trade, which began, at least in a small way, fully 500 years ago. As more and more white people settled in the East Indies, the demand for plumes rose. Finally, enough of them were imported to Europe to attract the attention of fashion designers. The plumes were featured on ladies' hats, and fabulous prices were paid for them. Wallace describes how the natives of Aru hunted the birds around the middle of the last century: "They shoot the birds with a bow and arrow, the arrow having a conical wooden cap to the end as large as a tea cup, so as to kill the bird by the violence of the blow without making any wound or shedding any blood. The trees frequented are very lofty; it is therefore necessary to erect a small leafy covering or hut among the branches, to which the hunter mounts before daylight in the morning and remains the whole day, and whenever a bird alights they are almost sure of securing it."

Beginning about 1880, the hunting of birds of paradise developed into a prosperous trade and reached a peak about 1910. Malay and Arab plume hunters penetrated far into the unexplored regions of Dutch New Guinea and along the coast. Whole towns subsisted on the plume trade. Hollandia was a town of 700 in 1923. In addition to the Malay hunters and their Papuan companions, there were Chinese, Arab, and Dutch traders. The prohibition of hunting in 1924 brought about a slump, and when I visited the region in 1928, Hollandia was a regular ghost town of only 30 or 40 people, like some of the famous mining settlements in the West.



➤ A PAIR of Magnificent Birds of Paradise in courtship. The male is in the full glory of his display, with his velvety shield glistening like burnished metal and his yellow cape thrown forward

Drawing by B. F. Chapman

The hunting of the plume birds was a strictly seasonal affair. Though male birds of paradise do not have a regular eclipse plumage like certain ducks and passerine birds, they have to go through an annual molt like all birds. Naturally, the plumes are in best condition shortly after this molt. The Malays knew by experience when that date was reached and fixed on it the opening of the season. Hundreds of small expeditions then left the coast to settle in some village in the interior, which served as the base of operations. From here every morning, Papuan hunters went to the neighboring forest to hunt for males in full plumage.

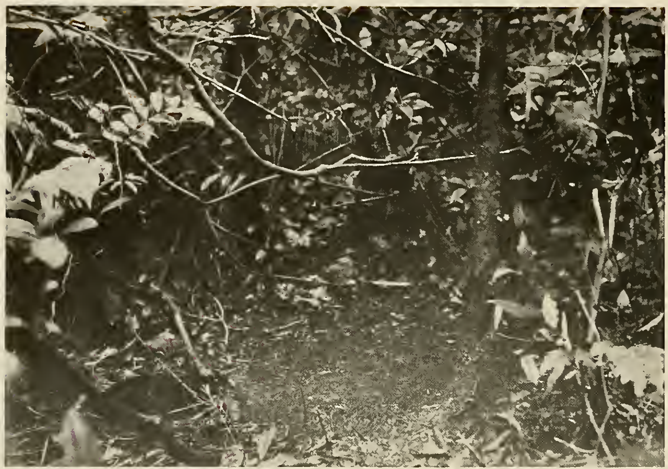
After several months, when all the trade goods had been exhausted and all the adult males in the neighborhood collected, the little expedition made its way back to the coast. Here great celebrating took place, and I am told that between gambling and drinking many of the Malays lost all their hard-won gains within a period of a few weeks.

In former German New Guinea and in the Australian part of New Guinea, the hunting was usually in the hands of the white residents. The hard-struggling colonists found in this trade a means of support while waiting for their plantations to mature. Most of the plantations in eastern New Guinea grew coconuts, which do not begin to yield profits until they are about 8 or 10 years old. Meanwhile, the plantation labor had to be paid, and in the absence of any other income, the birds of paradise were a lifesaver to many of the colonists. In a few weeks they could collect enough birds to pay for all the expenses for the rest of the year.

The number of skins exported annually from New Guinea was appalling. In 1913, for example, no less than 30,000 birds of paradise appear to have been offered for sale in London auctions. In the years before the last war, around 10,000 birds were exported annually from German New Guinea alone. In a single shipment in 1912, a British firm received 28,300 skins. Some figures indicate that as many as 80,000 were exported from Dutch New Guinea in a single year.

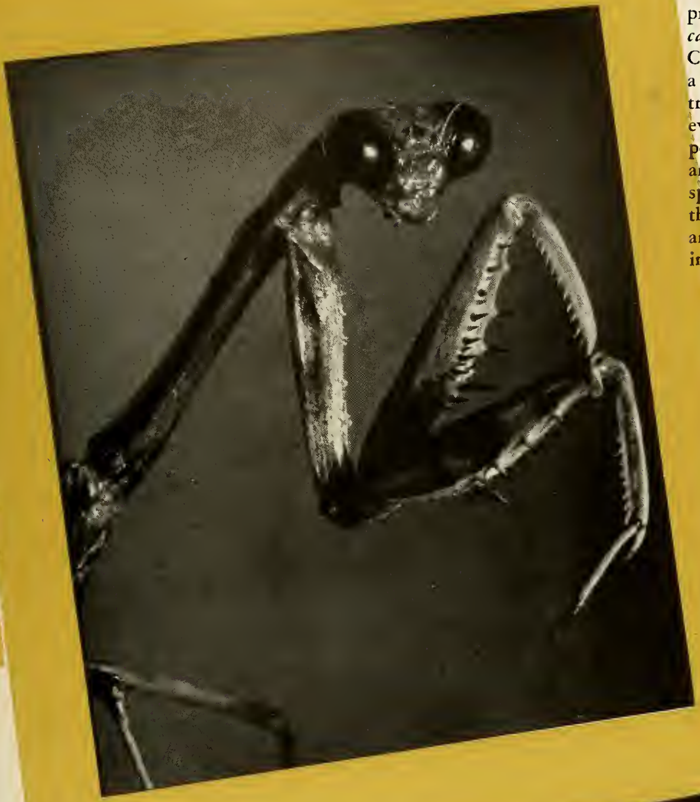
Conservationists throughout the world feared that birds of paradise were definitely threatened, even though the hunters spared the females and immature males and did not hunt out of season. Finally, the season on birds of paradise was closed completely. Since 1924, no birds of paradise have been collected legally, and even the illegal hunting has been negligible. When I visited Hollandia in 1928, I was surprised to discover that birds of paradise were displaying right in the outskirts of the town. There were numerous display trees within a few miles. Obviously, the birds had made a wonderful recovery within only four years. The mountain species, of course, had never been under pressure. If they are scarce in collections, it is either because their habitat is very remote, as in the case of King Albert's Bird of Paradise, or because they are very rare even in nature.

So much for the birds in their natural home. Words can never fully portray their beauty. And for this reason, New York is fortunate in having this new exhibit, in which are displayed a number of outstanding specimens from the world's finest collection, along with related information. It is hoped that many persons will see it.



Ernst Mayr photos

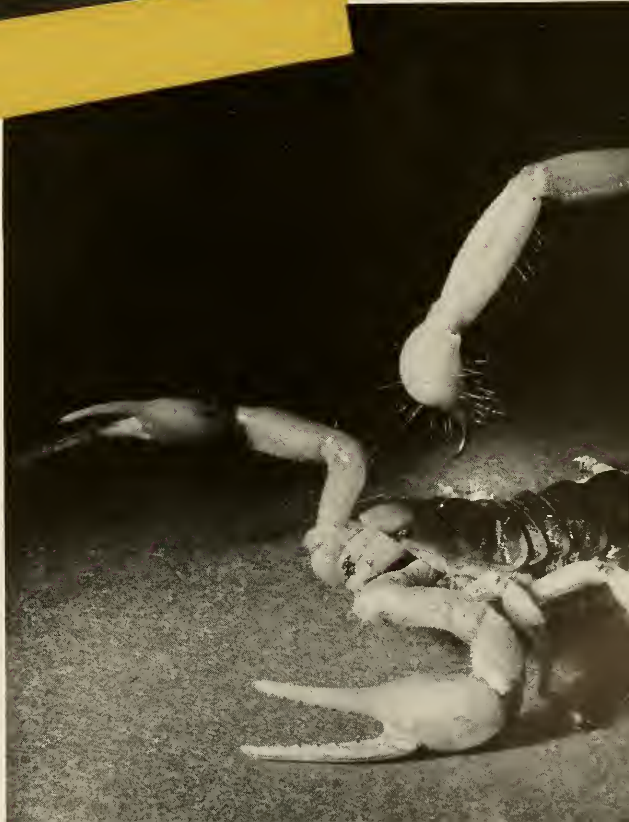
CERTAIN birds of paradise prepare "dancing grounds," in which the male displays his iridescent plumage in an elaborate courtship ceremony. (*Above*) Nicely spaced horizontal branches characterize the dance floor of the Flagbird. (*Below*) Vertical branches are required by the Magnificent Bird of Paradise on which to perform



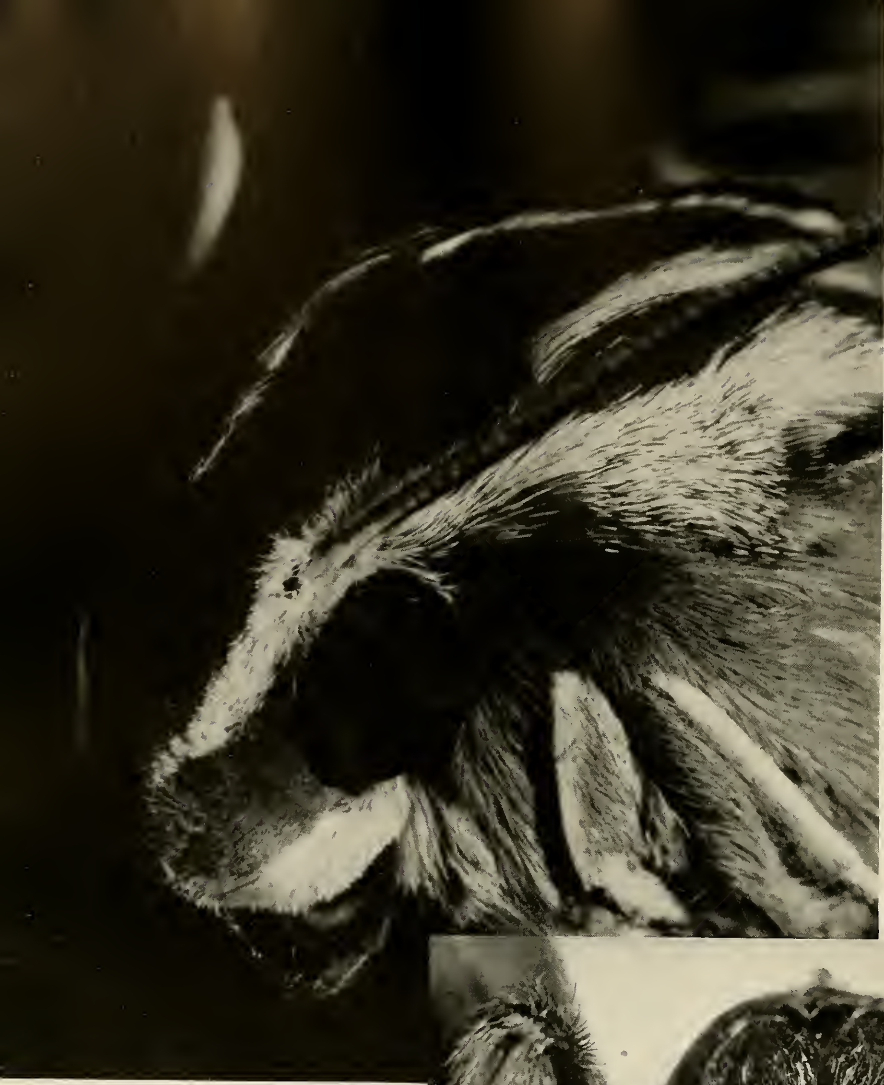
◄ OUR COMMONEST native preying mantis, *Stagmomantis carolina,* is smaller than the Chinese mantid and occurs over a much larger part of the country. It habits are the same, however, and its front legs are perfectly modified for catching and holding prey. The rows of spines on the front tibiae of the Carolina mantid are shorter and less numerous than in the imported species

By RICHARD L. CASSELL

A Gallery of INSECT PORTRAITS

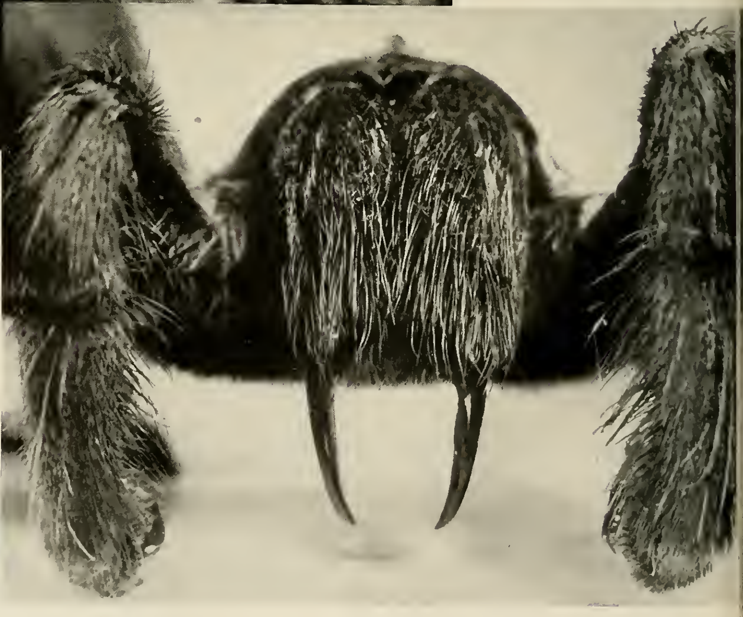


➤ ONE OF OUR LARGEST SCORPIONS (*Hadrurus arizonensis* Ewing), in defensive posture. Curled over the back is the long "tail," with the sting at the end ever in readiness to deal death to its victims. Although lethal to insects and other invertebrate prey, the venom of this species has little effect on man, the pain being comparable to a bee sting. In deserts of the Southwest it burrows into sand or hides under stones during daytime

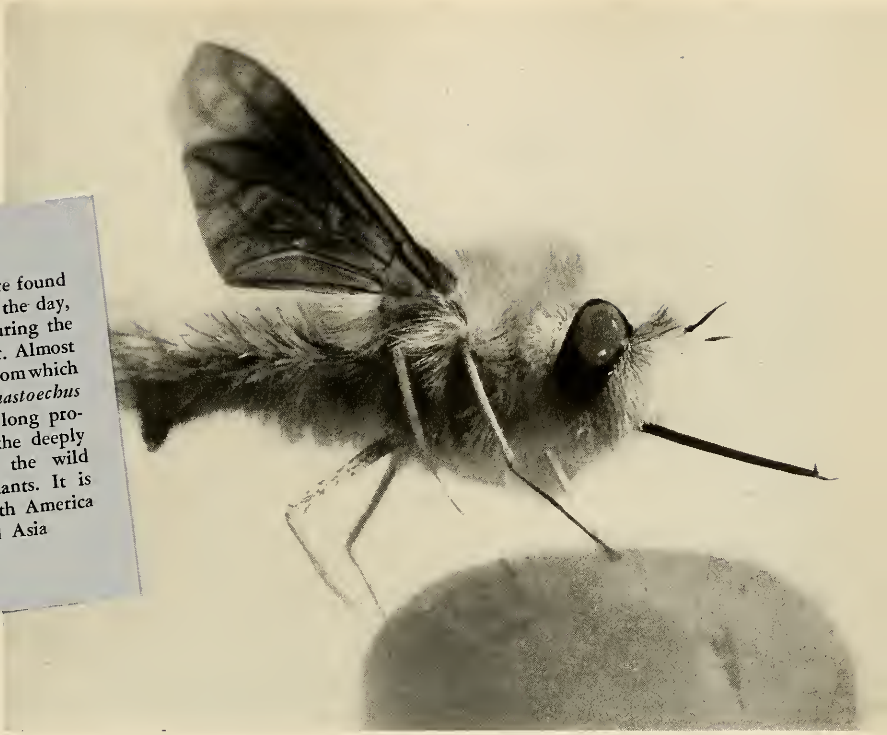


"The Sphinx is drowsy,
Her wings are furled."
—Emerson

◄ So rests this hawk moth, one to be seen at dawn or dusk of a summer's day visiting flowers, almost anywhere across the continent from southern Canada to the Gulf States. The "Striped Morning Sphinx" is a beautiful creature with white-striped forewings and broad pink bands on the hind-wings. The caterpillars feed on purslane, dock, and many other plants. Its scientific name is *Celerio lineata* (Fabricius)

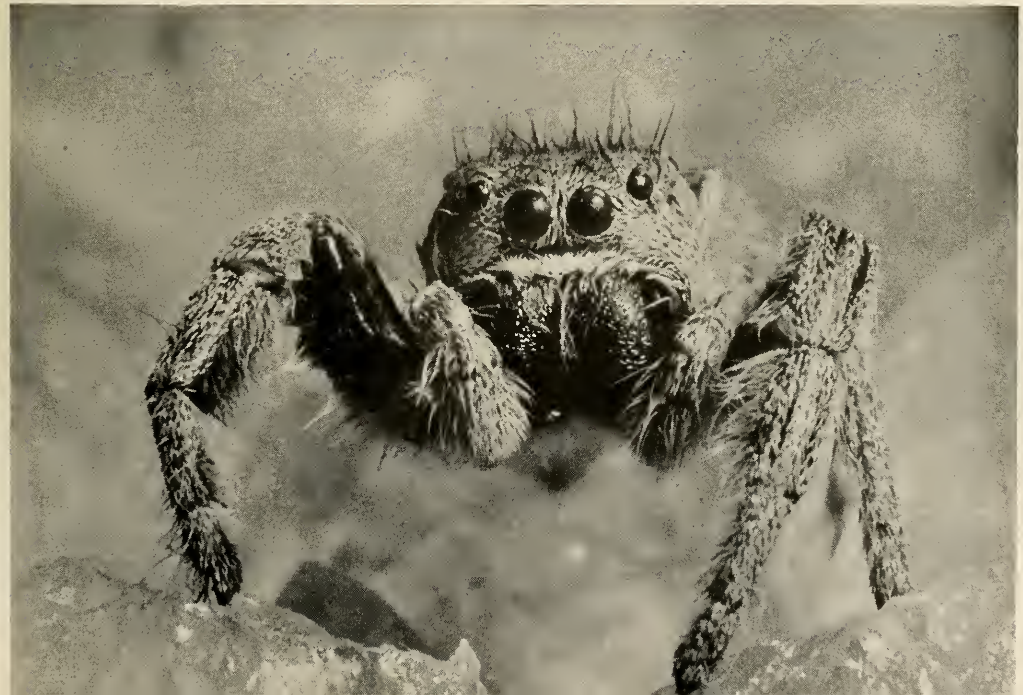


➤ Portrait of a Tarantula. Although they are the largest and most notorious of all our spiders, the shaggy tarantulas (*Aphonopelma* sp.) are extremely docile creatures. Their shining claws give the appearance of intense ferocity, but their venom has a very feeble effect on man. During the day, they hide in burrows that are made comfortable with their spun silk. At night, they wander boldly about and are often seen crossing the highways in our southwestern states

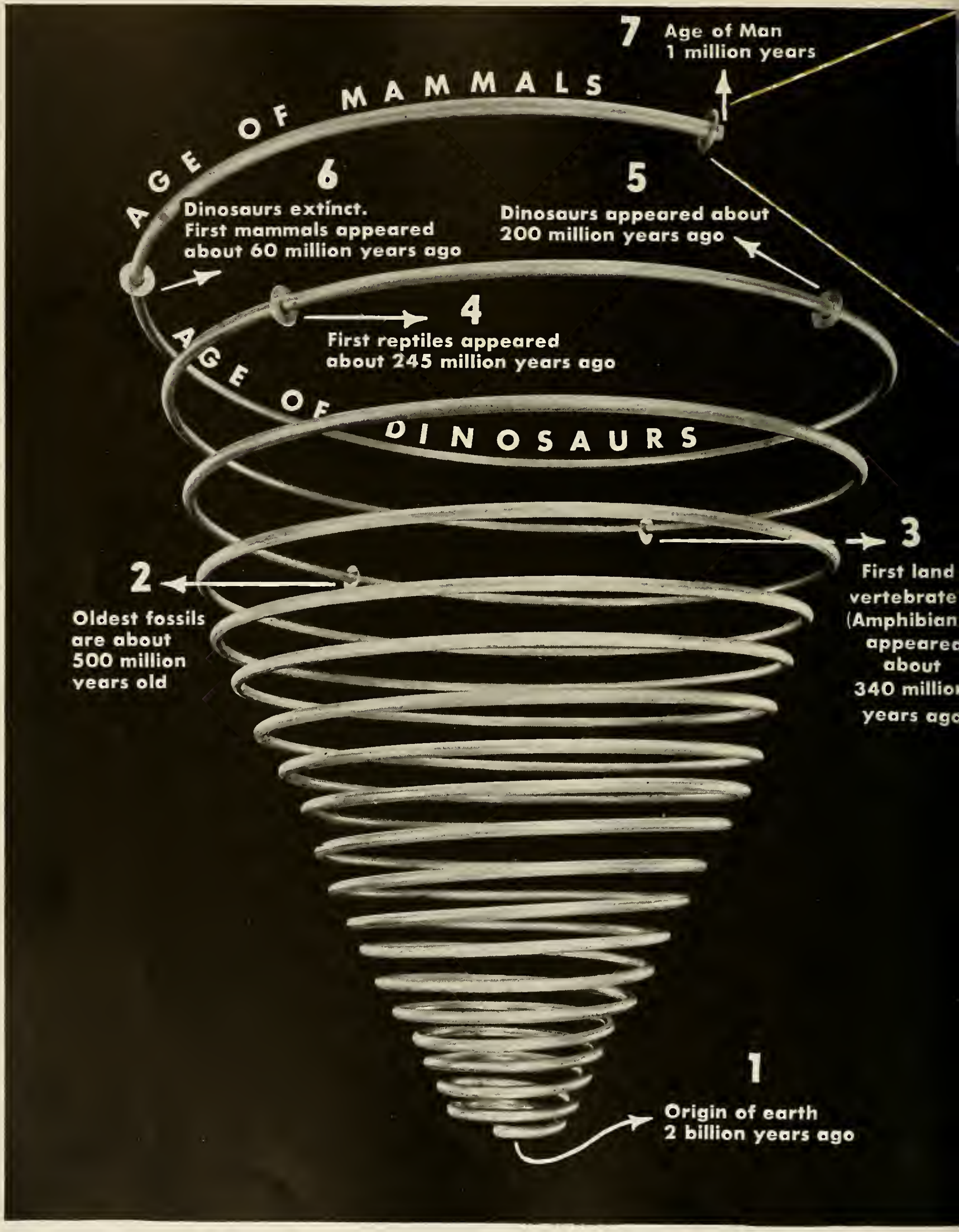


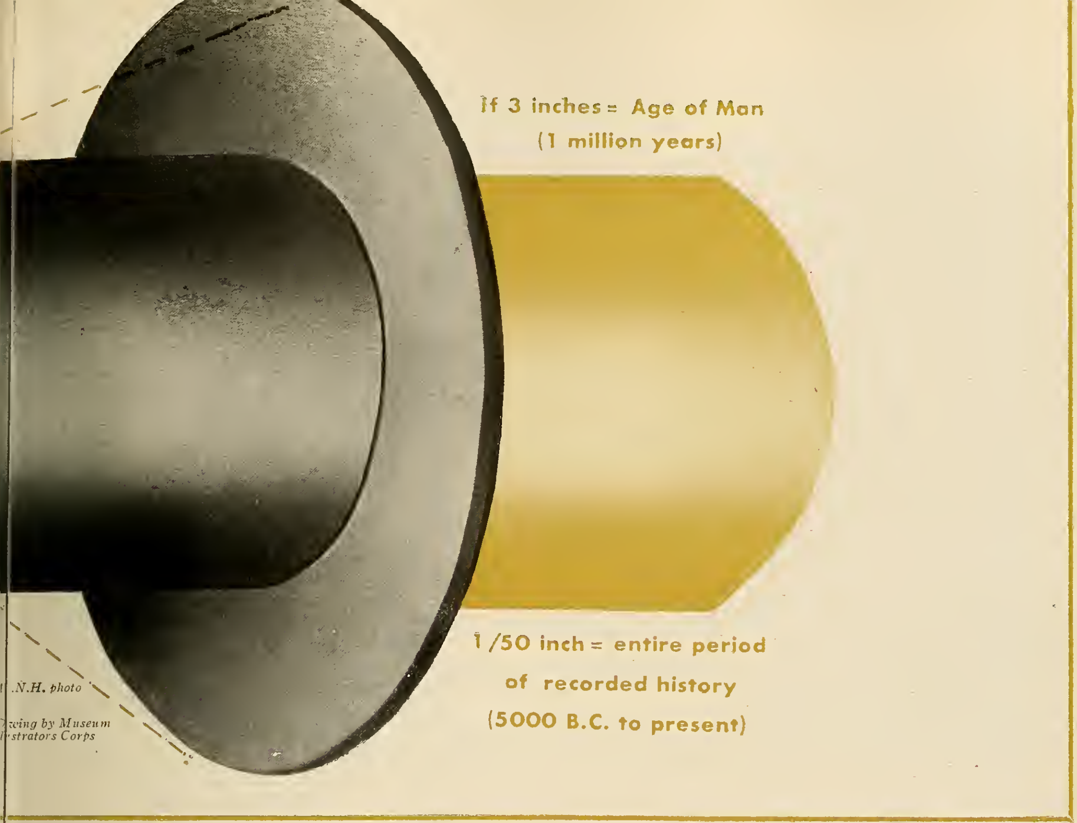
➤ **Bee flies** love the sun, are found during the hottest part of the day, and are most abundant during the hottest months of the year. Almost all of them visit flowers, from which they obtain nectar. *Anastoechus nitidulus,* because of its long proboscis, is able to reach the deeply seated nectar cups of the wild geranium and other plants. It is found not only in North America but also in Europe and Asia

➤ **Portrait of a Jumping Spider.** With stout bodies, often decked with colored scales, silky hairs, and miscellaneous finery, the jumping spiders swiftly pursue and leap upon their prey. Keenness of vision is an attribute of all these vagrant day hunters. The large bright eyes of the female below (*Phidippus* sp.) might well be trained in watchful attention on the male of her species, who with resplendent body and gleaming chelicerae, wigwags and beckons to her in his characteristic love dance



IMPORTANT THOUGH IT IS from the human point of view, our written history is too short to show on this spiral. The tip has been enlarged about 25 times, at right. This section representing man's one million years then becomes about 3 inches long. The last 1/50 inch of this represents the entire period of recorded history.


7
Age of Man
1 million years
AGE OF MAMMALS
6
Dinosaurs extinct.
First mammals appeared
about 60 million years ago
5
Dinosaurs appeared about
200 million years ago
4
First reptiles appeared
about 245 million years ago
AGE OF DINOSAURS
3
First land
vertebrate
(Amphibian
appeare
about
340 millio
years ag
2
Oldest fossils
are about
500 million
years old
1
Origin of earth
2 billion years ago



.N.H. photo

wing by Museum
strators Corps

A CALENDAR OF LIFE

Man is said to rule the earth, but others have ruled it before him. The most careful scientific estimates show that life has existed on earth for more than 70,000 times as long as man's recorded history

By EDWIN H. COLBERT
Curator of Fossil Reptiles, Amphibians, and Fishes, American Museum of Natural History

We are living in the Age of Man, the period in which man rules the earth. For better or for worse we have attained some degree of supremacy over all other forms of life. No longer is our existence threatened by large animals, as was the case with some of our not very distant forebears. No longer are we so seriously threatened by the less spectacular but much more deadly microscopic parasites, as were our ancestors of a few hundred years ago.

It is readily understandable that, having achieved this supremacy, we are apt to think of ourselves as the culmination of evolutionary history. And from our present-day standpoint this may be true. Yet there is another way of looking at it. Let us forget our natural bias as human beings and regard the question from an objective viewpoint.

Man has lived on earth for perhaps a half-million to a million years, which seems a long time. Of that great period, man has written only the last 7000 years of it into his record. Before the period of recorded history, man was a primitive savage, wresting his living from the soil and from the chase, ever surrounded by large beasts that challenged his right to the fields and forests.

Many years ago, in the dim past of earth history, lived the dinosaurs. These animals arose, evolved, and became extinct at ages so far distant from us that we can hardly stretch the imagination sufficiently to comprehend the immense passage of time that separates them from us. Since they are gone from the face of the earth, we are inclined to regard them as "failures" in the long history of life. Were they really failures?

Arising some 200 million years ago, the dinosaurs lived through a period of about 140 million years and were the dominant animals on land during all that time. Thus, for a stretch of time at least 140 times as long as the entire history of man, and more than twice as long as all the time that has passed since their day, the ancient dinosaurs lived and fought and died—the lords of creation. Who are we to say that they were not successful?

Certainly the span of dinosaurian history through a considerable portion of geologic time was tremendous as compared with the entire span of human history and prehistory. Indeed, to men generally accustomed to thinking in terms of human history, or per-

◄ *This unusual presentation will appear as part of* The Dinosaur Book, *soon to be published by the American Museum of Natural History* haps in fractions of human history, the whole subject of geologic time is staggering in its import, for its immensity is so great that the human mind can grasp it only with considerable difficulty. It is almost as if one were to try to understand infinity.

The earth is about two billion years old. This is not a mere guess but is the result of careful, cumulative studies by many investigators working over a long period of years and along various lines of evidence. Of particular use are the investigations of radioactive materials in rocks of ancient age. Largely by the study of the slow disintegration of radium and uranium into lead have we extended our conception of geologic time to its present tremendous limits.

Of the two billion years of earth history, only about one-fourth of it, or 500 million years, contains useful records of plant and animal life. In other words, 500 million years ago life on the earth reached the stage where the remains of plants and animals were of sufficient density and complexity to be preserved in the form of fossils.

The 500 million years of life history, as revealed by the fossil record, have been divided into three great eras, each marked by characteristic developments in the evolution of plants and animals. The first of the eras is the Paleozoic, the time of ancient life on the earth; the second is the Mesozoic or the middle period of life history; the third and last is the Cenozoic, or what might be called the "modern" section of life history.

Cenozoic and Recent Era	The Age of Mammals	Began 60 million years ago
Mesozoic Era	The Age of Dinosaurs	Ended 60 million years ago Began 200 million years ago
Paleozoic Era	The Age of Early Life	Ended 200 million years ago Began 500 million years ago
Proterozoic Eras Archaeozoic	The Ages with no fossil history	Ended 500 million years ago Began 2 billion years ago

Perhaps the relationships of the great eras of life history may be made clearer if expressed in the form of the simple table above.

The fossil record shows that during the early part of the Paleozoic Era there was a long period of many millions of years when lowly creatures without backbones were the only animal life. Then the fishes appeared and were the most important animals for more than 100 million years. Still there were no backboned animals on *land*. Approximately 300 million years ago the first amphibians crawled up out of the water, and for some 50 million years the world witnessed the Age of Amphibians. This was the period during which the first land vertebrates were evolving as descendants from their fish cousins.

The first reptiles, the earliest backboned animals that did not have to live in water during any part of their life, appeared before the end of the Age of Amphibians, but it was not until about 225 million years ago, that the reptiles became well established and the Age of Reptiles began. During the last 140 million years of the Age of Reptiles the dinosaurs were supreme.

While the Mesozoic Era (200 to 60 million years ago) was primarily the Age of Dinosaurs, there were, of course, other types of animals living at the time. Fishes and aquatic reptiles inhabited the water, flying reptiles and primitive birds were to be seen in the air, and (toward the end) small archaic, warm-blooded mammals lived on land. But these animals, important as some of them might be in view of the subsequent history of animal life, played relatively insignificant roles in the great drama of earth history. The real actors on the stage of Mesozoic times were the dinosaurs.

Then came the Cenozoic Era, the Age of Mammals, the period during which the furry, warm-blooded animals evolved and became supreme. The dinosaurs disappeared, seemingly unable to cope with new environmental conditions and with new competitors that had developed around them. During this era the evolutionary race was won by brains and speed, rather than by mere bulk, so that the mammals became increasingly varied and perfected. They inhabited almost every nook and cranny on the surface of the land, and some of them even reinvaded the water. This was the period during which the greatest perfections in vertebrate evolution were attained.

The culmination of the Cenozoic era was marked by the appearance of man. The last of the dinosaurs had long since passed from the scene, almost 60 million years previously. Man, even in his most primitive manifestations, was a relatively late product of evolutionary history. Physically, this new type of mammal was not even as well-developed or organized as hundreds of other types of mammals that had evolved before, or were evolving. But he was characterized by one trait by which he surpassed all the other mammals, even his close primate cousin. This was in the very great enlargement and perfection of his brain. Man became by far the most intelligent of all the mammals. This is a fact of the utmost importance in evolutionary history.

By reason of his intellect man was able to help himself evolve. He was able to resort to stratagems far beyond the capacity of other mammals, to invent implements that would increase his effective power, to use fire and to co-operate in a way that other mammals could not co-operate. Therefore, the development of man progressed at an increasingly rapid rate; he became a social animal, and cultures evolved. From then on, through the development of civilizations, man has increased and spread his dominance over the face of the earth.

Telescoping geologic time into a brief summary like this and returning to the Age of Man, we see that the span of our written history is infinitesimal in comparison with the periods into which life on the whole is divided. The days of ancient Egypt seem vague and distant to us, yet compared to the entire history of man on earth, they are as but yesterday. Man first appeared about one million years ago. The 7000 years of history are an insignificant portion. If the entire history of the earth were one day, man's recorded history would be less than one-third of a second. Two billion years are a long time.

TICKS AND HUMAN WELFARE

From unwise conservation policies to a child stricken with Rocky Mountain spotted fever is not so great a distance as you might imagine

By C. H. CURRAN
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NOT long after the first white settlers moved into the territory that is now the State of Montana some of them were smitten by a strange disease. In addition to all the symptoms of severe fever, the victims developed red spots on the wrists and ankles, and these quickly spread to all parts of the body. Even before the appearance of the rash and fever, there was usually a period of a few days when the victim suffered from loss of appetite and was clearly "not himself."

Parts of Montana, particularly the Bitter Root Valley, became notorious as "spotted fever country." But the disease was not wholly confined to Montana, though it was and still is most severe there. It extended over most of the Rocky Mountain area from Canada into northern Mexico and caused the death of from 1% to 70% of its victims, depending largely on season and locality. Because a great many kinds of fever are accompanied by red spots or rash, this type of fever came to be distinguished as Rocky Mountain spotted fever.

Today, the disease occurs in almost all the states of the Union, but there is no way of telling whether it always has or whether it has been spread by people returning from the Rocky Mountain region. Had we known as much 40 years ago as we do now, this might have been determined. But the disease was often diagnosed as typhus or any of several other fevers, and it was not until 1902 that it was proved to be carried by ticks.

During the past few years we have heard so much about insects and the diseases they carry that it seems that we must have known about these carriers for centuries. Yet we have known definitely of the role of insects and their relatives in the spread of some of our most deadly diseases for less than 50 years. And even less than 30 years ago many people scoffed at the idea that mosquitoes and ticks could kill people by injecting into their bodies a "poison" that caused fever. This is not surprising, because during the first two decades of the present century there were thousands of outstanding medical authorities who "pooh-poohed" the idea and held up to scorn the discoveries of the young scientists who were actually making medical history.

Rocky Mountain spotted fever was one of the diseases that was early proved to be carried by an insect relative—a tick. Ticks are most closely related to spiders, and they are generally included with them, because all but the newly hatched ones have four pairs of legs. Ticks carry Rocky Mountain spotted fever as well as a number of other diseases in North America. This was clearly demonstrated as early as 1902, but it was almost ten years before the fact was generally accepted. As a result, much valuable time was lost in studying the disease and its prevention. Indeed, even today few people know very much about it, and the great majority of our medical men have not come in contact with it. Tomorrow things are certain to be different because the many thousands of doctors who have gained experience in the war zones will be on the lookout for insect-borne diseases.

In North America, Rocky Mountain spotted fever is the most widely known of the tick-borne diseases of man. It is curious that in the West the majority of victims are men, while in the East, women most frequently contract the disease. It is easy to understand why men should be the most frequently attacked in the West, because in an agricultural pursuit they spend much time in the fields, but there seems to be no explanation why women should contract it more in the East.

The disease is transmitted by at least seven different kinds of ticks, including the spotted-fever tick (*Dermacentor andersoni*), Pacific Coast tick (*Dermacentor occidentalis*), the eastern dog tick (*Dermacentor variabilis*), and the brown dog tick (*Rhipicephalus sanguineus*). Only a few months ago it was demonstrated that *Amblyomma americanum* might prove to be as important as the other four kinds.

Fortunately, there are several factors that tend to prevent Rocky Mountain spotted fever from developing into a great plague. One of these is the amazing difference in its severity in different parts of the country and at different seasons (1% to 70% fatal). In the spring of the year, just after the ticks have come out of hibernation, one may contract the disease and become immune without even knowing it. But when the weather gets hot, or if the tick has fed during the sunny but cool spring days, the symptoms are usually quite apparent and death may result. Late June and July are the most dangerous months. When the weather gets really hot, the ticks find a suitable place in which to spend the "dog days" and stay there until the following spring.

Then, too, it is only the adult ticks that bite human beings, and only a very few of the seed ticks that hatch from the 2000 or 3000 eggs laid by a mother tick develop to the adult stage. Of all ticks in various stages less than 5% are generally capable of transmitting the disease, even in the worst disease areas.

Unfortunately, there is also a darker side to the picture. The female tick can transmit the disease to its offspring. The disease is carried through the eggs to the seed ticks and thus to the mature, man-biting adults. Only a small percentage of the offspring are infected with the disease, but these undoubtedly play an important part in keeping it going among rodents. Also, the common rabbit tick, which transmits the disease among rodents but does not bite man, helps keep it going among rats, mice, rabbits, and so on. Unfortunately, also, the apple cart may be upset by one of the dog ticks.

The brown dog tick has usually been considered to be a creature of warm or tropical lands. It is no longer that in the United States. The custom of families to spend the winter in some of the warm southern states has brought a new threat to northern areas. It is believed that the brown dog tick cannot stand our northern winters and that, even though it may be spread to rodents during the summer, it will die off when frosts set in. But it really doesn't have to worry about our winters because it can do quite well in our houses or in dog kennels. On the other hand, we do not have to worry about the seed ticks or nymphs biting us; only the adults will do that.

In the past we have associated ticks with rural areas, and our urban areas have been relatively free from them. The brown dog tick has changed this. Perhaps we should change its name. Possibly we should call it the "city tick," because it is the only tick that occurs more than incidentally in the large urban centers of our country. It is undoubtedly a potential menace to our health and to the well-being of our dogs and cats, but up to the present it has not caused any outbreaks of disease. Uninfected ticks are harmless. But if an urban outbreak should occur, the brown dog tick may play an important part in the spread of the disease. This is not likely to happen unless we are very careless and do nothing about getting rid of it.

The spread of the disease among mice, squirrels, rabbits, and other rodents is through the seed tick and young larval stages. If a tick infects one of the animals, other young ticks, feeding upon the animal can contract the disease and transmit it either to another animal or to man. The number of rodents suffering from the disease is relatively large in some areas, but the number of ticks able to transmit the disease to man is rather small, usually not more than one per cent. Thus it will be seen that the number of cases in any section will be determined partly by the abundance of ticks. The great increase in the number of ticks in some parts of the United States during the past 20 years may account for cases of the disease where it was not previously known.

Tularemia is less well known than Rocky Mountain spotted fever, and the death rate is lower, being about five per cent in man. It is, however, highly fatal in rodents, and it is probable that this disease is responsible for the periodic plagues that destroy large parts of the rabbit population. It is spread among rodents by a number of biting insects—fleas, lice, flies, and ticks, of which rabbit ticks are especially instrumental. This disease is transmitted to man by ticks but may also be contracted directly from diseased animals.

Most cases of the disease in man occur as a result of handling rabbits that have been shot. The disease enters the human body through the slightest abrasion and may possibly do so through healthy skin. Apparently, all rodents are subject to the disease, as well as foxes, coyotes, sheep, dogs, and many other small animals and birds, such as pheasants, prairie chicken, quail, etc. Bites of diseased animals transmit the disease, and it may also be contracted through handling their skins.

Tularemia is widespread in the United States and Canada, but as a rule the percentage of infected animals is very small. It is only when the disease approaches epidemic proportions among rodents that it may become a serious menace to man. Protection may be obtained by wearing rubber gloves when handling wild rabbits, other game, and vermin that have been killed. The pelts may be sterilized by soaking in a strong solution of mercuric chloride. The flesh of animals suffering from the disease is edible if it is thoroughly cooked, but the disease can be contracted from improperly cooked food.

Tick-borne relapsing fever is a disease of world-wide distribution in areas where the ticks classified as *Ornithodoros* occur. These ticks occur in the United States from Texas to Kansas and westward to California. In the latter State the disease occurs only at elevations of 5000 feet or more. As with the other diseases, it is a disease of rodents. It may be carried to man either by *Ornithodoros* ticks or by contact with diseased animals, in the same way that *tularemia* may be contracted. In areas where the ticks exist the same precautions as outlined above should be taken when handling dead rodents. The fever is usually severe, lasting from two to four days, with gradually lessening attacks occurring at varying intervals. A friend of the author who contracted the disease in California as a result of blood from a squirrel getting on his hands had attacks of the disease for many months, the attacks gradually decreasing in intensity and the time between them becoming successively longer. About 59 per cent of those suffering from the disease succumb to it.

The strangest and most inexplicable disease carried by ticks is one that is known as tick paralysis. No one knows just what causes the disease, which affects man and some range animals. Children are especially susceptible to tick paralysis, which may result in death in two to five days, but the cure is simple and effective. Ticks attach themselves chiefly to the upper part of the body. In most cases of tick fever the ticks have been found attached to the nape of the neck, from one to five being present. Apparently they must remain attached for at least two days before symptoms of paralysis develop. The treatment consists merely of the removal of the ticks. When this is done, recovery is rapid and the patient usually is fully recovered in two or three days, although in severe cases a week or two may be necessary before the victim can resume normal activities. This disease is caused chiefly by the Rocky Mountain spotted fever tick and therefore occurs only where this tick is found—in the area near the Rocky Mountains in this country and in British Columbia, where the number of cases is surprisingly large. The fact that there are dozens of cases each year demonstrates the gentleness with which ticks are able to attach themselves to human beings and to feed without the slightest knowledge on the part of the victim that his or her blood is being drawn off by a dangerous, disease-spreading parasite. (During the past year at least two cases have been reported in the East: the eastern dog tick would be the cause.)

Most of the ticks that carry disease to man in North America lay 2000 or 3000 eggs. Many years ago, when I knew little about them, I received a fully fed specimen of the Rocky Mountain spotted fever tick for identification. It was in a match box, and after naming it I left it on my desk. A day or two later I discovered that it had deposited what I estimated must be at least 2000 eggs. The mass was many times greater than the size of the engorged tick, and the tick had shrunk to the normal leathery form that sits on leaves and reaches for you as you pass by. Also it had died. I thought it would take some time for the eggs to hatch, but a few days later tiny seed ticks were crawling all over the place. Perhaps some of them found mice upon which to feed, but most likely they all died of starvation within two or three weeks.

The increase of ticks in recent years can be attributed to man's ignorance or selfishness. For example, a man might know that hawks destroy large numbers of field mice and rabbits, both of which destroy a goodly percentage of his crops each year. But just because certain kinds of hawks will grab an occasional chicken, every hawk that is seen is killed if possible. The chicken is worth a few cents, or at most a dollar. The hawk, by killing off rodents might well save the farmer many dollars in crop loss. It might do much more than that, too: it might save the life of the farmer's son or daughter by destroying rodents infected with tick-borne diseases.

The increase in the number of ticks is due to practices started many years ago. These practices are not only the result of individual action. They are mainly the result of the acts of organized society—the State and County governments. One of the chief causes was the payment of bounties for the destruction of wolves and coyotes. There is no doubt that both these animals caused severe losses to ranchers in many instances, and we cannot condemn the logic that led to their extermination in many areas. But we cannot escape the fact that the result has been an enormous increase in the numbers of rodents. At the same time that we were killing off the four-legged predators, including foxes, we were also killing off as many hawks and owls as we could. Then too, in many parts of the country there have been (and still are) organized snake hunts, in which all kinds of good and bad snakes are killed. It just happens that the poisonous snakes are among the most beneficial ones.

It should be apparent that by killing off these animals we have rather badly upset the balance of Nature. As a result, rodents have increased enormously, and great rodent-poisoning campaigns have been carried out, at great cost. It is natural that we should have done what we did, because few of us realized what the effect of killing off a few predatory animals might be. It is not the few that one individual kills; it is the cumulative effect of what everyone kills that adds up to the serious total. In this case it has added up to a great increase in the number of rodents and a disproportionate increase in the number of ticks. When rodents were less numerous than they are now, the seed ticks had a lot of trouble finding something upon which to get a full meal, and almost all died. But with more rodents running around, the ticks have a much better chance of surviving. Several hundred seed ticks or nymphs may be feeding on a single mouse, rat, squirrel, grouse, rabbit, or woodchuck. This had always been the case, but when these animals were less abundant the ticks were much less numerous too, and the danger of their spreading disease to man was much less than now.

The wily fox seems to be reappearing in places where he has not occurred for many years. He loves mice, ground squirrels, and rabbits (which we are not allowed to kill, except in limited periods). If the fox should become more abundant, there will be fewer hosts for ticks, and even if we are called upon to pay with an occasional chicken, we should not object too strongly. That chicken may save the life of a member of our family—it will be a cheap price to pay.

From this brief summary of ticks and human disease one might possibly come to the conclusion that it is very dangerous to go into the country where ticks may be found in fairly large numbers, but this is far from true. When we examine all available data and analyze it, we find that human deaths as a result of tick bites constitute only a very minute percentage in the vital statistics of our country. Up to the present time ticks have been relatively unimportant in their relationship to human diseases, and we might reasonably expect them to remain so, were it not for the fact that these creatures have been increasing to an alarming degree in recent times. We do not believe that this increase will cause any such epidemics as occurred in the days of the "Black Death" in England and the rest of Europe. We do know that all the potentialities of such a plague exist in the large numbers of diseased rodents and ticks in America.

To offset this danger a large number of scientists are at present watching developments with an eagle eye. And they are working with good hope that methods of destroying the carriers of the threatening diseases will keep one jump ahead of human epidemics. Progress has been made, and greater progress, perhaps certain cure, may come as a result of the unbelievable amount of research being conducted in connection with the war effort.

Hermits don't always live alone

By ARTHUR CARPENTER *and* WALDO H. LOGAN

If you visit lonely Mona Island toward the end of August, as we did on two occasions, you will see the Hermit Crabs [*Coenobita diogenes* (Latreille)] hold their strange convention. It happens on almost exactly the same day each year.

Mona Island lies halfway between Puerto Rico and Santo Domingo and is a tableland of limestone and coral that has been lifted bodily out of the sea. The crabs occupy nooks and crevices in the rocks on the top, amid a wild growth of thorn bush, brush, and Spanish bayonet. Sheer cliffs 80 to 200 feet high, which can be scaled only with difficulty, guard their stronghold. After the habit of hermit crabs everywhere, each one lives in a discarded sea shell and never moves about without it. These empty whelk shells range in size from your thumb to your fist.

This is what we saw. Almost with one accord on the proper night, the crabs made their way to the edge of the cliff and commenced to climb down. Many fell, and not a few were killed. But the great majority struggled down to one sizeable beach, a three-acre triangle of sand. Within 48 hours, the great horde had congregated.

During the heat of the day, they gathered in cooler spots to form heaps, some of which reached a height of four feet. Wheelbarrow loads of them, even boatloads, could be found in a single pile. In a forenoon you could gather enough hermit crabs to fill a moderate-size house. They climbed up on small trees until the branches bent to the ground.

At sunset they scattered over the beach. Then came the startling event. The jamboree began, and it was as though the grandfather of all hermit crabs had called through his megaphone: "Change shells with the lady on your right." The hermit crabs came out of their portable houses and began to exchange them. It was moving day, dance marathon, and bargain basement rolled into one. A good many were soon looking the worse for wear; but the brawl went on. The night sea was still, yet you heard a scuffling, clicking, and rattling as loud as gentle surf on a shingled beach. It was the frenzied antics of tens of thousands of little people of the sand, playing "musical chairs."

Less than a week after the start,

▼ ROUGH, ROCKY SHORES rise steeply to the top of Mona Island. The hermit crabs use of the few beaches. Mona was a favorite h out of pirates. Captain Kidd himself visite

Photo by Waldo H. Logan

▲ THIS TORCHLIGHT SCENE was taken on the beach the first night of the "convention." The second night the crabs were so thick you could not walk without kicking them aside

➤ THIS SPECIES OF HERMIT CRAB differs from all others in being "left-handed," that is, the left pincer claw is better developed, instead of the right. The empty shells they apparently prefer to occupy are those of *Livona pica* (Gmelin)

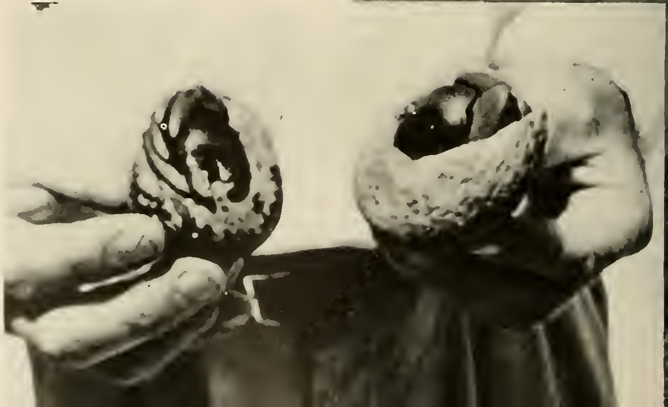

Photo by Waldo H. Logan

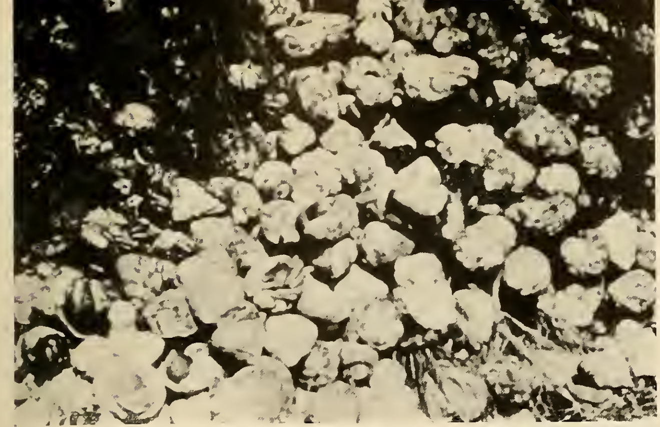

Photo by Waldo H. Logan

▲ DURING THE HEAT OF THE DAY, they gathered in cooler places to form great heaps. The exchanging of shells occurred almost entirely at night

the sun rose on an empty beach. The hermit crabs had all gone back into seclusion on top of their fortress rock—all except a few who had found the "trip to town" too strenuous.

The primary purpose of their migration to the beach, according to James E. Benedict, is for breeding. Other hermit crabs do not congregate in this manner, and the majority of species are never found very far from the water.

Photo by Arthur Carpenter

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A Gras

To become a full-grown ho
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On the side of a post in a weedy fence-row along a cornfield, the grasshopper clung head end up, his inch-long, brownish-green body blending closely with the weathered wood of his perch. From this high vantage point, except for his immediate front, he could see all around. If danger threatened, he could hop or fly away, or as was his more usual custom, he could either slide quickly around the post in timber-squirrel fashion, or drop suddenly to the weed-thicket beneath. He always accompanied this last trick by an additional one—a quick, sidewise scurrying from his point of landing. Only against those expert hunters, the domestic turkeys, was this last trick ineffective, for these birds had learned to strike a grasshopper at the instant of its fall.

All around him were dozens of his kind, some of them his brothers and sisters. All were alike as shelled peas, and all, save for an occasional waving of their feelers or mouthparts, sat quietly as he was sitting, their bodies held in inconspicuous fashion parallel with the post. Also, like him, each pictured its surroundings through huge lidless, immovable eyes, and each held its long hind legs in a great inverted V ready for instant action. But he paid them no attention, and they, none to him, for, except when mating, it is the way of a grasshopper to look only after himself. Besides, it was mid-day, a sort of rest period. Each and all were chockful of tender corn leaves, and being thus temporarily sated, were using the post both as a lookout and a shelter against the blazing July sun.

Nothing, of course, of what has been said was passing through the grasshopper's brain as he clung there in the shade of the post. Not that he didn't have a brain. He had a rather big one, in fact, as insect brains go, a brain that received stimuli from sense organs such as his eyes and "feelers" (which were really smellers), and which directed the proper movements of his body in response to these. Strangely enough, however, his brain seemed to have little or no control of his muscles by way of coordination, for when, as sometimes happened, one of his kind had its head bitten off, the headless creature could still walk, jump, or fly for a time. Moreover, if men were right in their knowledge of him, his brain, like that of Burns's mouse, gave him no power to look behind or forward by way of memory or contemplation. Hence, he couldn't think about danger until it presented itself, or recall, for example, that half-an-hour before he had narrowly missed being gobbled up by a sparrow-hawk. Of course he could not know that frosts were only two or three months ahead, frosts that would destroy both his food and himself.

Yet, for all that, there were to be found in his tiny body (and a score of his kind would be required to weigh an ounce) all the organs and machinery necessary for him to function as a perfect animal. Like the birds and snakes and frogs and skunks that preyed upon him, he, too, had eyes, hearing organs, taste-buds, and a sense of smell and touch. He, too, could breathe and digest food and add new substance to his body; could circulate blood, fly, walk, hop or swim, and bring others like himself into the world.

Which is not to say that he was constructed upon the same body plan as that of the backboned animals, or that his internal workings were carried on after their fashion. For Mother Nature has a way of arriving at the same end by many different means. According to her plan for the construction of all insects—some 600,000 different kinds of them—she had used no bones in the building of him, but, instead, had fashioned his skeleton from a hornlike substance. Stranger still, she had placed that skeleton on the outside of him. It was as if his body had been poured into this jointed armorlike covering, his muscles all being fastened to its inner side.

Nor had lungs been used in his make-up. True, as he sat there against the post, his body wall rose and fell in a regular breathing rhythm, but no air entered his body through a nose and from thence to lungs as he breathed. It rushed instead, through tiny holes which pierced his armor at the sides, holes connecting with tubes that branched to carry air to every cell and tissue. Hence, although a food distributor and a carrier of wastes, his blood had little or nothing to do with the carrying of oxygen. Neither was it red nor confined in blood-vessels. It seeped slowly through open body-spaces into every corner of him, some of it being constantly sucked into his heart to be sent at every beat on its slow way through his body. Also, as if to add to his peculiarities, his "ears" were placed just above his hind legs, hind legs so long and powerful that only a few creatures in the world could equal him as a jumper.

Such was the grasshopper as he clung there to the post. But, full-grown, fully functioning, energy-transforming machine that he now was, he had been thus for only a few days. For he had been hatched from an egg barely three months before, that egg having been deposited by his mother during the preceding fall in the soil of this very fence-row only a few rods from where he now sat. By the use of four sharp blades at the rear of her body, she had drilled a half-inch-deep hole into the sandy soil and had placed therein some 50 or 60 tiny, banana-shaped eggs all glued together. But laying her eggs in a suitable spot—and the fence-row, because of the unlikelihood of its being ploughed up, was such a spot—was his mother's sole contribution to the welfare of her family. For she died shortly after without seeing or perhaps ever knowing what came from them.

As a matter of fact, the soil around them being still warmed by the September sun, each egg began to transform into a grasshopper. And though this process may have been retarded with the onset of winter, the advance of spring found them well on the way to hatching. One morning in May, along with the rest of the brood, the grasshopper kicked himself free from the egg shell and scrambled upward through the sand to take his first look at the world.

opper sets forth

By Roy L. Abbott
Professor of Biology, Iowa State Teachers College

Men call young grasshoppers "nymphs." But tiny, pale and wingless fellow though he was, with a huge head and a baggy skin or skeleton, both seemingly far too large for him, it was easy to see that he was a grasshopper. No absurd, wormlike infancy stage for him as was the case with his remote relatives, the flies, the moths, and the beetles.

But in spite of his size, in a few hours after emerging he and the rest crawled up the stem of a cockle-burr and began to feed. By evening the cockle-burr leaves had a shot-hole appearance, the holes being cut by the busy jaws of the nymphs.

Also, in a few days, the young grasshopper's body appeared less wrinkled. It was as if he had grown enough to fill up his over-large skeleton, just as a boy may "grow into" his brother's old suit.

In fact, as a result of his enormous appetite, his skeleton soon fitted him so tightly that something had to be done about it if he were to get any larger. For the young grasshopper—as is the case with all insects—on account of his unstretchable covering, could not grow up by gradual, barely perceptible degrees like a child. So as his skeleton became uncomfortably tight, he left off eating, crawled under some low leaves and remained very quiet. The molting-period had come, the first of several such events which must take place before he could become a full-grown grasshopper.

As the moment for casting his outer coat approached, he closed his breathing pores and began gulping air. This air, filling his digestive tract, raised the pressure within him. Increased by his vigorous wriggling, the pressure soon became too great for his old coat to withstand. It parted suddenly along his back in a wide rent, and after more wriggling, he finally crawled out of it, renewed, so to speak, both without and within, for incredibly enough, his cast-off outer coat carried with it the linings from his mouth and intestine and airtubes.

After thus ridding himself of his old suit, the grasshopper appeared larger than before, but very pale and weak, for his new skeleton was still soft. But it would harden quickly, and if he were to gain any advantage from the shedding process he must stretch his new garment while there was yet time. Hence, guided by that inborn instinct which told him what to do next, he continued to take in air and stretch himself to such an extent that it would have been impossible to have fitted himself back into his old coat. And so as the result of all this, he found himself once more with an over-size skeleton into which he would again fit himself by a period of active feeding and growth.

Four times more in succeeding weeks he went through this same weird process. From each of these seeming new-births, he came forth with a bit larger body and a head more in proportion to the rest of him. And now with the last molt past, having attained full growth and functional wings, he sat on the post sleek and trim, not so voraciously hungry as he had been as a nymph, but wide awake and ready to play his role in the grasshopper world.

In arriving at physical maturity, the grasshopper had accomplished a rather rare thing in the world of his kind. Thousands of mature hoppers were near him there in the field, of course, but for each one like himself, 50 or more had died on the way. Of those who had hatched with him, for example, only two or three had matured. Half of them, perhaps, had been eaten by birds. Several had died from fungus growths picked up by their near-naked bodies while molting. Several had hopped blindly into a garden spider's web to be promptly bitten and swathed into silken mummies. Some had been seized and carried off to be sucked dry by robber flies. A shrew had made a meal of several; and a night-prowling skunk had picked off a dozen as they slept along the ragweed stems.

Even as he sat there on the post in seeming security, danger lurked overhead, for a tachinid fly was hovering near. It required only a second for that fly to dart downward and touch one of the hoppers, and that touch, when made, was the touch of death. For it left a tiny egg poked between the joints of its victim's body. And that egg would hatch, bore into the flesh, eating as it went, leaving a trail of ruin and eventual death in its wake.

But as was said at the outset, the grasshopper knew nothing of all this, neither what had gone before nor what was to come, his brain being geared to meet only the stimuli of the immediate present. For the moment at least, those stimuli were to his liking. It was warm and dry there on the post; his belly was full of food, and he was unaware of any danger. When night came he would sleep with a crowd of his fellows along the vertical stems of near-by weed-stalks. Each morning (for the next month or so) he would awaken to a replica of the preceding day's doings—a feeding and a resting and a keeping out of harm's way.

But to this daily round he would soon add another activity. For with his last molt, sexual maturity had come, and with it, the first sensing of a new urge, the need for a mate.

As a result it would come about that when the frost of October arrived and he and his mate were dead, 50 or 60 fertile eggs—the product of him and his mate—would lie well hidden in the fence-row waiting the coming of another spring.

WE WATCH BEETLES

Continued from page 259

none of them had ever held a beetle. Nevertheless the urgency was obvious and each one took a vigorously squirming specimen. Determined not to let the insects escape yet not to crush them by too firm a hold, waves of mixed emotions chased over our friends' flushed faces to record every wriggle of the captive beetles.

We wanted to see later stages in the beetles' life cycle, but the end of our short vacation from war research kept us from staying to watch for beetle young. Why not take a pair home with us? We filled an enamelware pan with earth to a depth of perhaps four inches, and placed two dead mice on top. Very obligingly the sexton beetles came flying to our bait and buried them where they lay. Covered by a screen, the dish and all its contents traveled 500 miles to Philadelphia while the self-buried parents tended the incubating eggs. Weeks later we dug them up and were able to add to our movie record some close-ups of sexton beetle grubs, fat and yellow, ready to transform into adults.

It's fun to watch beetles! But it surely is hard on our friends!

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A GREEN GOLIATH MEETS ITS DESERT DAVID

Continued from page 263

might be better off elsewhere. Larger numbers of coyotes might favor the cactus area, but they are not necessary. Grazing is the chief adverse factor.

At the same time, we must remember that even if measures such as these could be carried out, the healing hand of Nature works so slowly in the desert that it would be at least 50 years by the most optimistic estimate before pre-Gadsden conditions could be restored and reproduction of saguaros again established in the Cactus Forest. It would take another 50 years for those seedlings to attain stature remotely comparable with that of the present patriarchs.

Surely the saguaro is worth saving. This gray-green Goliath, this majestic vegetable water tank of the desert, is a veritable trade-mark of the Southwest. If it is a sufficient tourist attraction to stir business men of southern Arizona with the desire to retain it, there should be hope for its survival.

Thousands of acres of saguaro-dotted desert in southern Arizona have been turned under by the plows of cotton and alfalfa farmers and citrus growers. Other thousands of acres of desert have been subjected to grazing, coyote hunting, woodcutting, and all the activities of civilization that have brought about conditions reducing or entirely preventing saguaro reproduction. However, there still remain a few spectacular stands of saguaros that are more favorably located and are still perpetuating themselves. Plants of all ages are about equally represented in these spots. It is still possible to save one or more of these normal stands *if* proper protection to perpetuate natural conditions is assured now; now, before woodcutters, cattle, and coyote hunters can lay the foundation for 50 or 100 years hence when the disease will build up to another epidemic among mature saguaros unable to reproduce.

One spectacular stand of saguaros is that of Tucson Mountain Park. Another but less extensive stand is within the boundaries of Organ Pipe Cactus National Monument, south of the mining town of Ajo; and there are others. Mining interests a few years ago exerted pressures that opened Organ Pipe Cactus National Monument to prospecting, and prospectors must cut firewood, and, in some instances, timbers for bracing and shoring. Most of them graze pack stock and shoot coyotes on sight. Where miners have had their chance and found nothing, it would seem fair now to take measures to protect the scenic and educational attractions. If strict regulations could be enforced now and henceforth, the most important conditions favoring normal reproduction would be preserved. But there is strong opposition to the enforcement of the very regulations so essential to the preservation of the saguaros.

Lessons learned from the extinction of the passenger pigeon and heath hen came too late to save those interesting manifestations of primitive America. Classic principles of wildlife conservation engraved upon our understanding by the cougar-deer experience of the Kaibab Forest of Northern Arizona were acted upon in time, and only the healing scars remain to remind us of that near-tragedy.

Will the spectacular groves of these desert Goliaths one day be found only in museum dioramas and in photographs, where future generations will get only a meager impression of the splendor that "His Majesty, the Saguaro," once imparted to the desert? Or will the unsightly skeletons gradually take the background and remain only as reminders of another triumph in conservation?

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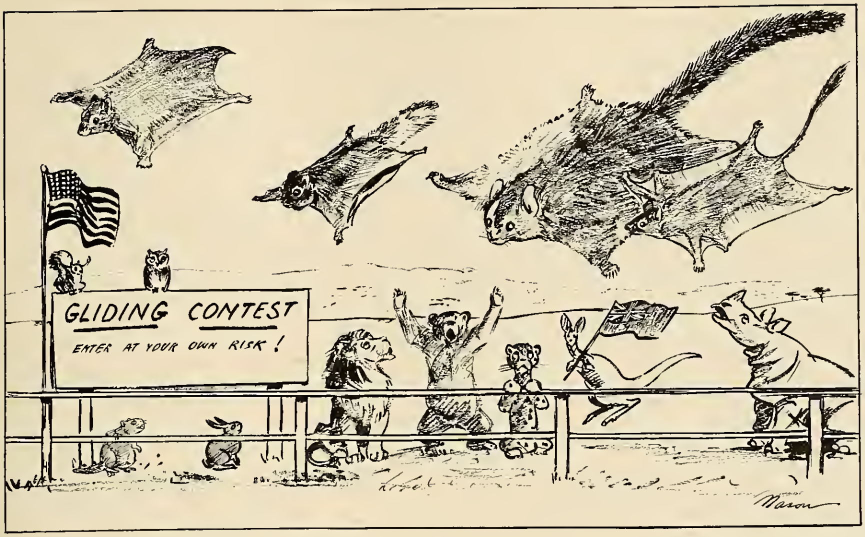

By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

ALTHOUGH bats are the only mammals that can actually fly, members of four different mammal families have become living gliders, making use of the same forces as man-made gliding machines do. The force of gravity causes an unsupported body to fall, but if this body has sufficient flat surface to take advantage of air resistance, it may be carried a long distance before landing. All of us as children have folded paper to make small gliders; and natural gliders include the autumn leaves, elm seeds, and many other similiar objects.

Even the common mammals that live in trees can make use of air resistance when they fall or jump from heights. I once followed a large squirrel to the top of a pine tree, some 75 feet high, trying to take a close-up photograph of it. When I approached within four feet, it jumped clear of the tree. As it fell through the air, the squirrel spread out as flat as it could, with legs and tail extended. Although it landed with a thud on the hard, sun-baked ground, it recovered its breath in a moment and ran up another tree.

The mammalian gliders have improved on this, developing broad skin-folds, which, stretched between the fore and hind limbs, present a plane surface to the air and enable these animals to glide from tree to tree with little loss in altitude. First among the gliders in its degree of adaptation is the cobego, colugo, or flying lemur of the Malay region and the Philippines. It is about the size of a cat, with a somewhat doglike face and long, slender limbs. The limbs support a wide, thin membrane that begins on the neck, includes the fingers and toes, and extends to the tip of the tail. The cobego would need only long fingers and powerful breast muscles to graduate from gliding to flying, but although it can control its direction, it depends entirely on air-resistance for support and on gravity for the necessary motive force. Students of flight in birds and bats believe that gliding was a stage in the development of true flight.

Flying squirrels, properly so called, are the best known of the mammal gliders, though not the most efficient. The two species in the eastern United States are soft-furred, grayish brown animals that frequent our woodlands and are active during the hours of darkness. They are related to the tree squirrels, with typical rodent teeth and skull. In eastern Europe and widely distributed in Asia are other species of the same family. Those found in the Indian and Malay regions are especially varied. Some are giants of their tribe, brightly colored flying squirrels more than a yard in length. The gliding membranes of these large forms are especially wide, hampering their movements on the ground or in trees but allowing them to sail through the air for some 80 yards.

Flying squirrels can turn almost at right angles from their course in mid-air and can control the angle and consequently the speed of their glide. At the end of a glide, the animal checks its speed by swinging upward and lands head-up on the tree, its goal.

The African scaled-tails look like and are often called flying squirrels. They are rodents but belong to a family of their own, far removed from the squirrel family. At the base of the tail, on its underside, are the large overlapping scales from which these rodents derive their name. The gliding membrane in these animals is supported by a stiff rod of cartilage attached to the elbow, while in the flying squirrels there is a similar strut arising from the wrist.

In Australia, New Guinea, and near-by islands, there are gliding marsupials, distant cousins of the kangaroos and koalas. Locally they, too, are called "flying squirrels," but they are phalangers, greatly different from rodents internally though similar in appearance. Like other marsupials, they have pouches in which the young are carried on these flights. One species is large, a yard long including the long tail, while another is a pigmy, hardly larger than a mouse.

Thus, four unrelated tree climbers have developed the same means of escaping from enemies; they sometimes seem to glide just for the fun of it.

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spot I landed at was within a few miles of 1° 15′ South, 133° 28′ East. The mountain that was visible must have been Togwormeri, and the landing strip (where you'll find your pygmies) lies on a course of 239° from Manokwari.

We flew down the coast until we hit a me to turn south and fly until we saw small grassy plain, then the guide told what we were looking for. The flight wasn't too bad, but not knowing the terrain any too well and being afraid of running into the side of a mountain, I "buzzed" all the way. The little Valiant just purred along, and I was enjoying myself by staying as close to the tree tops as I possibly could, first, because of the Japanese and second, to see how the native guide would take it. He turned blue at first but got accustomed to it after a while.

My altimeter slowly began climbing. We had been in the air about one and three-quarters hours, and if we didn't find the place soon I would have to turn back. I checked the gas and decided about ten more minutes was all I could give to the search. The terrain of the country here was different from anything else I had seen in New Guinea. It reminded me very much of the Feather River country up in California: tall trees well spaced, beautiful grassy plains, and mountains towering on all sides. I estimated them to be somewhere around 10,000 feet. Then at last we came to a smooth plain and saw natives hopping up and down, waving cloths and things. I dropped down to within ten feet of the ground and, sure enough, there were white men among them. I turned the ship around and landed, trying my darndest to keep from killing half the natives, who ran out and began petting the plane even before it stopped rolling.

The natives were pygmies all right. The tallest was about four feet eight, and he looked like a giant among the rest. The average height, I judged, was about three feet eight. The most notable thing about them was their superb physique. They were all normal; not a deformity in man or child, nor any sores or skin diseases such as I had seen among the natives along the coast. They were also much lighter in skin color. *Their hair was black but it was not kinky; it looked soft and silky,* reminding me of Chinese hair, although it was much finer. Both sexes wore it hacked off short, and some wore a head covering made from the colored silks used in parachutes for dropping supplies. Generally the features were clean cut, the nose somewhat aquiline in shape, mouth wide with thin lips, teeth very white and well shaped, ears small and set close to the head. The shape of the skull did not strike me as unusual, but the women did strike me as being very nice looking. Others earlier must have noticed that, for there were a few half-white children running around in the crowd.

The pygmies appeared a happy, intelligent lot, and evidence of the latter was seen in the workmanship on the ornaments they wore. Everyone wore bracelets and necklaces of some metal that looked like gold, set with green stones something like emeralds. And they were well worked. (I ought to know; I was with a manufacturing jeweler before I went in the service, and my specialty was working with pearls.) Some of the women, in addition to a white bone three or four inches long thrust through an incision in the ear lobe, wore solid gold earrings! If it wasn't gold, it looked enough like it to fool me.

For weapons the men carried a sort of dart or spear about four feet long. It tapered to a point at both ends and was thick through the center and weighted with something heavy. The knack of throwing it was not easily acquired, as I found out later. You grasp the weapon by the weighted center and throw it as you would a stone. It is supposed to revolve once and then fly straight to the target. I didn't think it could be done until they showed me . . . and the natives' accuracy with such a cumbersome weapon was remarkable.

The women wore the usual cloth around the waist, and the men were covered with a loincloth of rough weave; but two chiefs to whom I was introduced were *draped* in the uniforms of Japanese colonels! The blouses fitted all right, the sleeves fine, but the pants were much too large and long and made their flat feet sticking out below look twice as big and flat as the others'. The chiefs were very polite and affable, but I noticed that they kept staring at my mouth, and whenever I spoke or laughed the rest of the natives just stood and looked at my face. There must have been 400 pygmies in the crowd, and not one of them so much as breathed hard! During those moments, the vast silence in that valley was incredible. I must admit I began to feel a bit uncomfortable and finally asked one of the Dutch why the natives looked at my mouth so intently. He asked the chiefs, and they told him it was the gold in my mouth, my gold inlay! Very much relieved, I invited them up for a formal inspection, opening my mouth wide so they could get a good look, but the chiefs shooed the rest back. They evidently wanted to be the source of information after I left. Yes indeed, the two agreed, that was the thing all right! Gold in the teeth. No doubt they began cramming in gold inlays and pushing out teeth as soon as they could get to their supply—which makes one wonder where their supply of gold does come from.

I didn't see any huts or shelters anywhere near. One of the white men told me that because of the proximity of the Japanese, the natives' houses were well hidden in the woods. And I can believe it. Since then I've flown many times over this same area, purposely swinging off course on the way home from a strike, and I could never even locate the field again. I've also flown at treetop level trying to spot the pygmies' village but could see nothing but trees, grass, and mountain streams. I could only conclude the jungle had once more claimed its own.

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YOUR NEW BOOKS

MAMMALS OF THE PACIFIC • CINCHONA
CAREERS IN SCIENCE • RELATIVITY

THE MEANING OF RELATIVITY

----------- by Albert Einstein

Princeton University Press, $2.00
135 pages

THE first edition of this book consisted of the text of Professor Einstein's Stafford Little Lectures, delivered in May, 1921, at Princeton University. For this second edition, Professor Einstein has added an appendix, of about 25 pages, discussing certain advances in the theory of relativity since 1921. In this supplementary chapter, among other things, the author discusses the confirmation afforded by Hubble's experimental evidence of the expansion of the stellar system, based on the red shift.

When one opens this little book, he is reminded of Jeans's remark, that the only conception of the universe that can now be framed is a mathematical conception, and that after we have it, only a mathematician can understand it.

Brilliant minds have attempted to make clear the theory of relativity, ranging from our popular writers, E. E. Slosson and Garrett P. Serviss, to our leading mathematicians, physicists, and astronomers. In this professional group we have Arthur S. Eddington, Oliver Lodge, Bertrand Russell, Frank Dyson, J. J. Thomson, J. S. Ames, Henry Norris Russell, Max Planck, H. A. Lorentz, W. de Sitter, and many others. But many students will wish to follow the reasoning in the words of the author of the theory, now considered "one of the highest achievements of human thought" since Newton's day.

CLYDE FISHER.

CINCHONA IN JAVA—

The story of quinine.

----------- by Norman Taylor

Greenberg, $2.50
96 pages, 16 illustrated pages

THIS interesting little book does not claim to present the results of original research on quinine. It is, as its subtitle indicates, merely the story of the drug which, during the three centuries of its use, has saved more lives than any other medicine. We of the northern states scarely realize the importance of malaria, but it is still rife in parts of our land, and Taylor says it costs us half a billion dollars per year.

Quinine comes from Cinchona trees, of which several species have been used. For more than two centuries medicine depended for its supply of quinine entirely on bark gathered from wild trees in the Andes. Cultivation of the trees began as early as 1865, and the Dutch have grown it with especial success in Java.

Mr. Taylor is a graphic writer and unfolds his story in a convincing manner. He tells us of the dreadful importance of malaria and of the startling discovery by Laveran, Ross, and Grassi of the microscopic plasmodium which causes the disease. He tells us of the discovery and early history of quinine, of its increasing importance to the white race as colonization of the tropics proceeded, of the efforts to grow Cinchona trees on plantations, and of the gradual increase in the yield of quinine through application of modern methods of plant breeding. In short, he has brought together in ninety-six pages as complete a story of quinine as the layman will wish, while his bibliography will serve as a guide to further and deeper reading.

H. A. GLEASON.

SCIENCE IN THE UNIVERSITY

By Members of the Faculties of the University of California

University of California Press, $3.75
332 pages, 7 plates

THIS volume, among others thus specially designated, was published in commemoration of the 75th anniversary of the founding of the University of California, and it should be of particular interest to all who have ever studied at this great western institution of learning. Included in the book are nineteen chapters or essays on as many branches of science.

The first chapter is a classical treatment of the progress of the fundamental science of Astronomy, entitled "Driving Back the Dark," by Dr. Robert Grant Aitken, Director Emeritus of the Lick Observatory. This chapter alone would justify the book. "Trees and History," by the paleobotanist, Dr. Ralph W. Chaney, who was on the 3rd Asiatic Expedition headed by Roy Chapman Andrews, is an interesting story of the pre-history of California. Here the reader is reminded that fossil trees represent the thermometers and rain-gauges of the past; that the prints of leaves and seeds in sediments now turned to stone, and petrified logs buried in the gravels of ancient streams, constitute the documents from which much of the pre-history may be read.

Besides these there are chapters on Cosmic Rays, Molecular Forces and Solubility, Organic Chemistry, Meteorology, the California Current, the Evolution of a Sierran Landscape, a Modern Conception of Living Material, the Theory of the Gene, Longevity in Organisms, the Trend of Bird Life from the Fossils through the Present, Plant Nutrition, Physiology, Psychology, Oceanography, and finally a closing chapter entitled "Life, Morals and Huxley's 'Evolution and Ethics'."

It is evident that the topics treated are all scientific, and they were written for the general public. While some are excellent pieces of popular writing, others are only semi-popular, and a few are necessarily rather technical. Altogether the book is a worthy volume commemorating the progress of a great University during three-quarters of a century.

CLYDE FISHER.

MAMMALS OF THE PACIFIC WORLD

----- by T. D. Carter, J. E. Hill and G. H. H. Tate

The Macmillan Company, $3.00
227 pages, 69 illustrations

AMONG the few things that can be marked in black ink in the crimson ledger of war are heightened interest in distant parts of the world and increased knowledge of them. Pacific islands that were not even names to us a year ago are now being seen by thousands of American soldiers and are becoming familiar to the rest of us through letters and publications. Strange native tribes and unfamiliar animals and plants live on these islands. The interest that these awaken is reflected in a constant and growing flow of inquiries received by museum curators from service men, their families, and the public in general. To answer this interest with authentic, comprehensible, and readily available information, the American Committee for International Wild Life Protection has sponsored a series of seven books on the Pacific World, each of which is being issued in a paper-bound edition for the armed forces and in a library edition for the public.

This region produces some extravagantly queer and exotic mammals, such as the platypus, the bandicoot, the cuscus, the koala, the wombat, the gibbon, the tarsier, the linsang, the mouse deer, and the babirusa, to mention only a few. The book provides excellent information for service men and for those who followed their painful adventures from afar. Many of the Pacific islands have no undomesticated land mammals except the ubiquitous mouse and rat, introduced by man, but some, such as Sumatra and Japan have exuberantly varied mammalian faunas, and the many outlandish mammals of Australia are also included. The three authors, who are all on the Staff of the American Museum, have collaborated to make this book a masterpiece of organization and conciseness.

Beyond the appearance and habits of the animals, the book discusses the basic principles of mammalian history, migration, and distribution. There is a glossary (somewhat too brief) and a check-list of the mamals of each island or island-group.

This book is recommended without reservations, both for its immediate utility and for its permanent value.

G. G. S.

SCIENCE TODAY AND TOMORROW

by Waldemar Kaempffert,
Second Series

The Viking Press, $2.75
279 pages

IT is evident that no survey of science can be final. The object of this book is to bring up to date the progress of science as outlined in the essays of the first series published only six years ago. Some of the first series is already out of date, and has been omitted. In fact, more than half of the second series is new, and among other advances recorded here is the influence of the war, always a profound impetus to science and invention. The author reminds us that Leonardo offered his services to the Duke of Milan primarily as a military engineer, and that Galileo was a professor of military science.

In this volume we have 24 chapters on as many different phases of present-day science, including the prospects for tomorrow, written in a popular, imaginative style. The subjects of the essays include "Science, Technology, and War," which might have been titled "The Evolution of Warfare"; "The Chemical Revolt Against Nature," in which is related the story of the sulfa drugs, the discovery of penicillin, etc.; "After Coal—What?"; "Life in the Solar System"; "Birth and Death of the Moon"; "Can the Laboratory Create Life?"; "Electronics"; and "Through Science to World Unity."

These stories are dramatically told in non-technical language for the layman by the Science and Engineering Editor of the New York *Times*. Mr. Kaempffert was for eighteen years editor of the *Scientific American*, and editor of *Popular Science* for five years. He was the first director of the Museum of Science and Industry in Chicago, founded by Julius Rosenwald. His background and experience, together with his literary gift, have qualified him to prepare a fascinating book on science brought up to date.

CLYDE FISHER.

THE ELEMENTS RAGE

by Frank W. Lane

London: Country Life, Limited
10 shillings, 6 pence,
188 pages, 46 illustrations

THIS is an entertaining work concerned solely with the violent manifestations of nature, their origins, and something of their effects. Hurricanes, tornadoes, waterspouts, hail, snow, lightning, meteorites, earthquakes, and volcanoes contribute to the subject matter, and all are discussed in wholly non-technical and entertaining language. Each chapter has been checked for accuracy by at least one expert, and the author has indicated in footnotes those places where the experts have failed to agree or have felt that the statement given was not sufficiently inclusive. A terminal bibliography (including several references to articles in this magazine) adds to the value of the book for the serious reader.

There is much miscellaneous and interesting information to be found within these pages. Did you know, for eaxmple, that the Empire State Building was struck by lightning 63 times in 3 years, and during one storm, 15 times in 15 minutes? Or that the largest single hailstone of which there is authentic record, which fell at Potter, Nebraska, in 1928, was 17 inches in circumference and weighed a pound and one half? When cut open it was of layered construction, proving it to be one stone—not an aggregate of stones. Larger stones are believed to have fallen. One collected at Heidgraben in Germany in 1925 measured 9.8 x 5.5 x 4.7 inches and must have weighed 3 or 4 pounds, but it may have been an aggregate of several stones frozen together. These are but samples of the unusual information brought together here and supplemented by some remarkably fine illustrations.

It is a pleasure to recommend this book to those who are interested in pleasant and instructive reading on natural phenomena.

H. E. VOKES.

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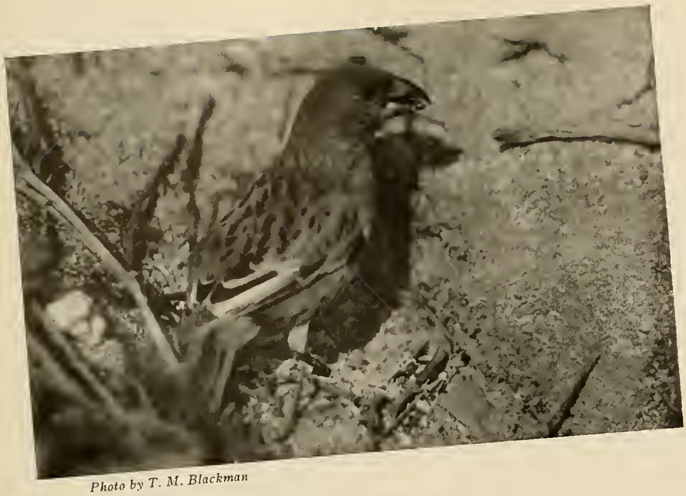


Photo by T. M. Blackman

WAR CASU

◀ A FEMALE LAYSAN "FINCH" detaching and eating portions of the root of the "Beach Magnolia" (*Scaevola frutescens*) on Eastern Island, Midway

The only three land birds inhabiting Midway Islands have been exterminated

By THOMAS M. BLACKMAN

THE news that Midway's only three land birds have recently been exterminated came as a shock to bird students in Hawaii, and application has been made to the Naval authorities for information regarding this event.

The official report, published in an article by Mr. George C. Munro in *The Elepaio,* Journal of the Honolulu Audubon Society, leaves no room for doubt. Due to the admittance of rats to both islands of Midway, the Laysan rail (*Porzanula palmeri*) and the Laysan "finch" (*Telespiza cantans*) have completely vanished. And the third species, a large and flourishing colony of imported canaries (*Serinus canarius canarius*), two of which were last seen in the vicinity of the Cable Station on October 20, 1944, has apparently also been exterminated.

Although none of these birds was indigenous to Midway, their loss is a serious one to the bird life of the Hawaiian Islands. The flourishing colonies of the Laysan rail and the Laysan "finch" at Midway contained the only representatives of these species in the world, with the possible exception of a smaller number of the "finch" still believed to exist on Laysan.

Laysan Island, the original home of these two birds, lies 360 nautical miles closer to Honolulu than Midway, in the northwestern Hawaiian chain. It was long famous as the chief breeding place of the albatross that bears its name and of enormous numbers of various other ocean birds. From the year 1890 until 1904, the island was exploited commercially for the collection of guano for use as fertilizer. Shortly before the latter date, rabbits were imported and liberated by a resident on the island, and they increased so rapidly that in a very few years the entire vegetation of Laysan was on the verge of disappearing. The rabbits were dying of starvation, and the four species of small land birds, found exclusively on this small island, were faced with extinction owing to failure of the food supply.

Fortunately, two of these small land birds, the Laysan rail and the Laysan "finch," had been introduced on Midway and were becoming established. The rail was completely exterminated on Laysan, and the Laysan "finch" decreased until only a few survived there. The other two land birds of Laysan vanished from the face of the earth. One, a somber-colored little songster known as the "miller-bird," succumbed because it could not find the moths upon which it depended for food. The other, a small honey-eater, perished through lack of shelter and food.

In February, 1909, President Theodore Roosevelt issued an executive order creating the Hawaiian Bird Reservation. This sanctuary for bird life included all the islands of the northwestern Hawaiian chain with the exception of Midway. And with Midway under the jurisdiction of the United States Navy, its birds were receiving, up to the beginning of the present war, very similar protection to that accorded on the other islands. Therefore, a feeling of greater security for the bird life of these islands had existed.

The loss of so interesting a species as the Laysan rail is a matter of deep regret to all who take an interest in birds. Moreover, it can easily be the forerunner of other misfortunes yet to be discovered, resulting from strenuous conditions during war activities.

Throughout the winter of 1939-1940 and the ensuing spring, the writer had numerous opportunities to observe the habits of the Laysan rail and the Laysan "finch" at Midway, where both were very numerous over almost the entire area of both islands.

The Laysan rail, although only about six inches in length and quite flightless, gave one the impression of being the quickest thing to be seen on two legs. Its cry was heard at all hours of the night, leaving one to suppose it was just as active then as during the daytime, when it might regularly be seen searching beneath the vegetation on almost any part of the two islands, with the exception of bare patches of sand near the shore lines.

The Laysan rail was chiefly an insect eater, and it rendered good service by its untiring attacks on the flies that were such an annoyance to residents at Midway, especially during the summer months. It was adept at catching them when they settled on the dead birds that are always in evidence among crowded bird colonies. Running up quickly, it often succeeded in catching a fly before it could escape. The rail then usually ran quickly away to devour the fly a few feet distant before returning. By

ALTIES among the BIRDS

that time, other flies had generally settled, and the procedure was repeated. Should no fly then be present, or if the rail should miss catching a fly, it often walked around the dead bird to examine the opposite side and then proceeded to pick at it. Most of the dead birds had holes torn in their soft underparts, and rails were occasionally seen to examine these places for fly-maggots. On one occasion, a rail was seen to detach two or three feathers from a dead petrel's neck and release them.

In their foraging excursions, these rails were frequently seen to enter the burrows of petrels and shearwaters. Sometimes they would reappear almost immediately, but at other times they remained below ground for two or three minutes. I am unable to say whether the rails ate the petrel's eggs on these underground excursions, but they were observed to eat the contents of eggs that were found broken on the ground. It seems likely that insects of some kind were found within the burrows.

The Laysan "finch" was credited with doing much injury to various cultivated plants on Midway, but during my observations it obviously rendered good service in destroying great quantities of the troublesome, sharply spined seed cases of the creeping plant *Tribulus cistoides*. It picked these up from the ground and cracked them with its strong bill to extract the seeds, which apparently formed its main food supply. It also ate the white berries of the "Beach Magnolia" (*Scaevola frutescens*), and on one occasion was seen to remove and eat portions from the root.

This bird has a pleasant though not very powerful song. Like the Laysan rail, it eats any eggs it finds, if they are not too hard to break.

In early February, when the Bonin Island petrels (*Pterodroma hypoleuca*), so abundant on Midway, were laying their eggs, a number of the eggs were seen scattered on the ground each morning. There was much speculation among the residents to account for this. On February 5, fourteen such eggs were counted within a few minutes, and 150 were seen on a half-mile walk the same day. In the early mornings, most of these eggs were unbroken; but as the day advanced, it was difficult to find an unbroken one, or even any of the contents in the shells. The shells all bore what appeared to be the marks of a bird's bill. There were, of course, no rats at that time on either of the islands of Midway. Though I never saw either a rail or a "finch" break into one of these eggs, I twice saw a rail eating from one of the broken eggs, and on one occasion a "finch" was doing it. I heard of other instances of the "finch" eating eggs.

I was inclined to attribute the number of petrel's eggs on the surface of the ground to the accidental destruction of their nests by men walking on loose coral sand. It was not at all uncommon for one's foot to sink to a depth of a foot or more several times in the course of a short walk off the track. And each time one permitted this to happen, it probably left a bird entombed in its burrow or unable to enter it on its return. Birds in the latter predicament probably sometimes laid their eggs unprotected on the ground.

All of these things illustrate the disturbances that result from alterations of natural conditions. As an example of the disastrous effects produced on Laysan, it is on record that in 1923 only four species of plants remained out of 26 that had previously existed on the island. This was when the Tanager Expedition, sponsored jointly by the U. S. Biological Survey, the Navy Department, and the Bishop Museum of Honolulu, visited Laysan. One of its objects was the extermination of the remaining rabbits, and this is believed to have been achieved. Efforts have since been made to re-establish the vegetation of the island.

Bird lovers throughout the world are actively interested in preserving species that are threatened with extinction, but localities like these illustrate that it is not enough simply to protect the birds themselves. Care must be taken against the introduction of new enemies and against any threat to the food supply. Otherwise, unexpected dangers are apt to arise when it is too late to prevent serious damage. A better public understanding of these delicate relations in the world of nature is most important to the cause of conservation. Only with a broader knowledge of these basic principles can we expect wise legislation and intelligent participation by individuals.

▼ A LAYSAN RAIL catching flies. Advancing slowly until it is within a few inches of the dead petrel, the rail quickly runs up and often succeeds in catching the fly before it can escape

Copyright photo by T. M. Blackman

Arizona's Ancient Irrigation

By EMIL W. HAURY

Director, Arizona State Museum

Before Columbus came, America's Master Farmers had evolved an elaborate civilization, had accomplished amazing feats of engineering, had become highly skilled in the arts—and then had vanished

MANY persons, picturing the Early American Indian as the most elementary sort of agriculturist, are surprised that the so-called Hohokam people developed an elaborate irrigation system in the desert of southern Arizona before Columbus discovered America and as a result thrived by agriculture beyond the wildest dreams of their contemporary neighbors. Modern engineers, with their mechanical monsters for moving earth, would not be daunted by the task of duplicating their system. But no such aids were available to the Hohokam, not even domesticated beasts of burden. The construction of the canals was wholly by hand, from their planning to the back-breaking job of digging and repairing them.

If we begin to calculate the amount of earth moved, loosened with stones and sticks, and packed out on human backs, the figures become incomprehensibly large. Yet the evidence of the superhuman effort is there, clear and unmistakable. For output of labor on a single cultural feature, the Hohokam had no peers among the native Americans north of Mexico. The accomplishment earns for them, hands down, the title of America's Master Farmers.

In the Salt River Valley alone, canals, traceable in recent times, go an aggregate length of about 150 miles. They often attain a width of 30 feet, and depths of as much as ten feet have been measured. In a few places, they were literally hewn through stony formations.

Whether the Hohokam people invented canal irrigation or whether they borrowed the idea from others is academic. We do know that, by A.D. 700 or soon after, this type of farming was well established among them and that it increased in size and complexity to reach its greatest magnitude roughly between A.D. 1200 and 1400. It represented a major adjustment to inhospitable environmental conditions and paid rich dividends in security and leisure time for the people. Populous villages arose, and their occupants lifted the level of tribal attainment from mere existence to rich living.

What information we have about these people is the direct result of the archeologist's insatiable curiosity. No one knows what name they had for themselves. The placid Pima Indians, who today live among, and, in some cases in, the village sites founded by these earlier folk, recognized the ruins as the homes of the ancient ones—"those who have vanished," or the "Hohokam." This label, the archeologists have been quick to borrow.

For many years the Hohokam were regarded only as a regionally specialized branch of the Pueblo Dwellers, whose well-known cliff homes and large communal villages are scattered far and wide through northern Arizona, northwestern New Mexico, and the southern parts of Utah and Colorado. But, as more and more was learned about them, it became clear that the mode of life, architecture, treatment of the dead, and arts and crafts were too different to be included in the Pueblo pattern of culture. The early excavators, like Cushing and Fewkes, while they did not recognize the Hohokam as an entity separate from the Pueblo inhabitants of the fourteenth century, nevertheless made specific contributions by gathering a large body of facts. It remained for the personnel of such institutions as Gila Pueblo at Globe, the Los Angeles Muesum, Pueblo Grande Laboratory at Phoenix, and the Arizona State Museum at Tucson to piece together the main cultural story of the Hohokam and fill in many of the details.

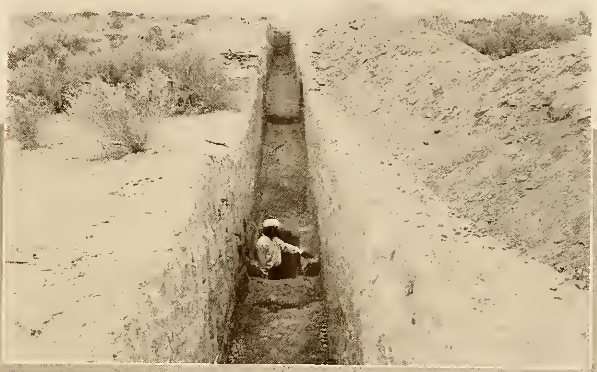
These canals also tell us something about Hohokam leadership. A project of this magnitude must have required not only a well organized system of directing labor battalions—but an integration of the efforts of numerous settlements that were to profit by the network of ditches. Authority here netted a strictly utilitarian and secular accomplishment as distinguished from the great religious edifices, equally consuming in labor, demanded by the theocratic civilizations of the Aztec and Maya.

When archeologists work with the tangible vestiges of a bygone people, representing their history over generations of time, it is inevitable that differences in these products should become apparent. The house types may vary in form and earthenware vessels may show marked alterations in shape, design, and color. Cultural items may appear suddenly and others may die out. Change, to a greater or lesser degree, is inherent among all peoples. It is this very fact that permits the archeologist to arrange the history of a group like the Hohokam in chronological sequence. This has been done most effectively for the Hohokam by leaning on the principle of stratigraphy. When the architecture and other relics of one generation lie buried beneath those of another, it is known that they are older. Applying this principle, painstaking

Builders

▼ A TRENCH dug at right angles through an irrigation ditch at Snaketown. The Indian stands on the floor of the oldest of three superimposed canals dating from the Colonial Period (about A.D. 600-900). Silt subsequently filled this canal, and it was later re-excavated to form the second irrigation artery. The Indian's left hand rests on the latest of the canals, which was in use during the Classic Period, perhaps around the fourteenth century, as revealed by pottery fragments found on the floor

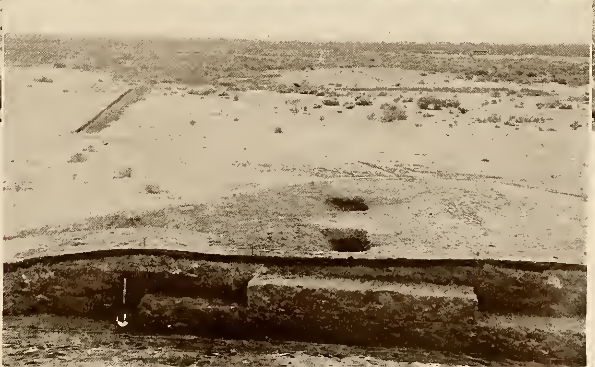
Gila Pueblo photo



▼ A VIEW of the desert landscape that America's Master Farmers made to flower between about the time of Christ and A.D. 1400

Photograph by Tad Nichols

➤ RELICS left by the people at different levels of occupation at the same site reveal four stages in their history. This photograph of a Hohokam trash mound in process of dissection shows the archaeologist's method. Each rectangular block of trash was excavated as a unit and screened. Materials showing human workmanship thus sifted out were carefully analyzed. About 175,000 pottery fragments were taken from this one mound at Snaketown



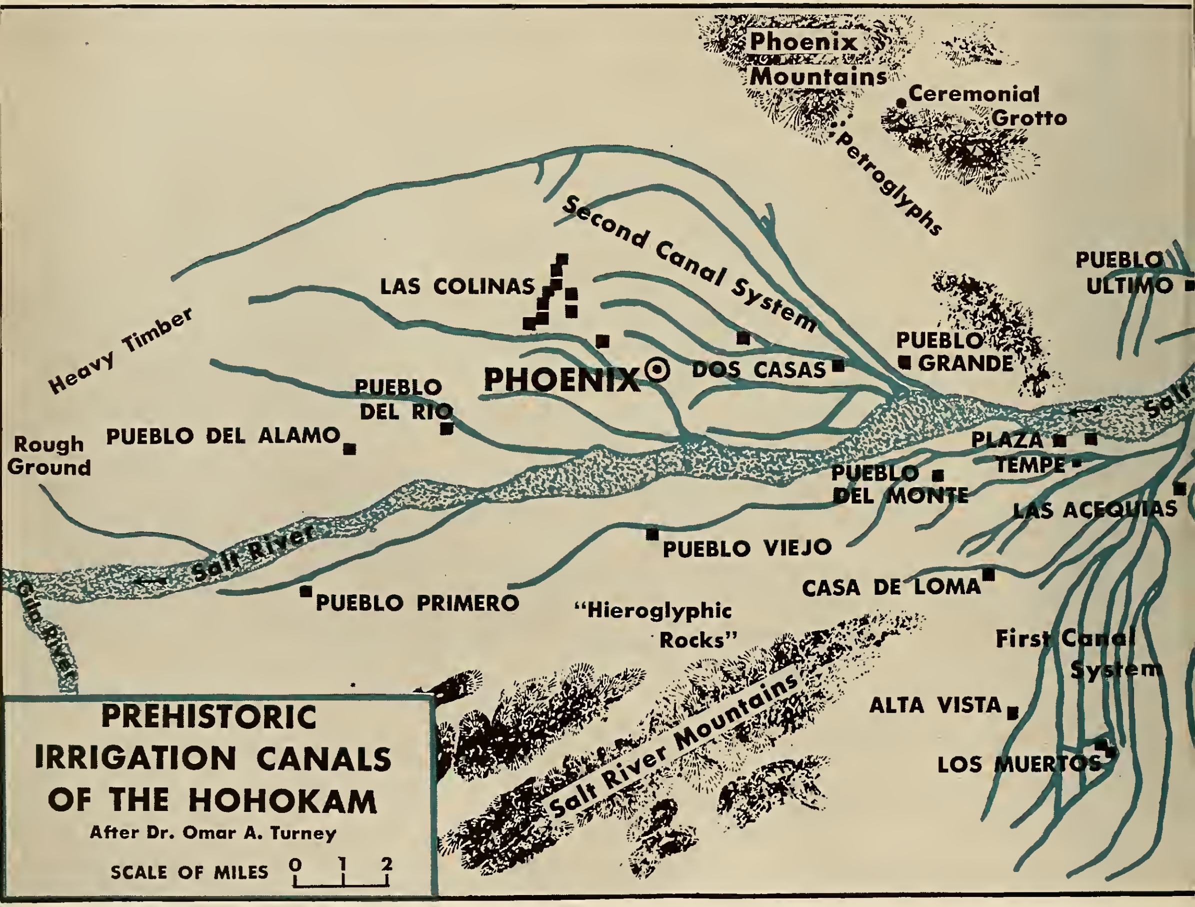
Gila Pueblo photo

study of deep trash deposits at Snaketown by the Gila Pueblo Museum has given us a picture of the Hohokam over a long period.

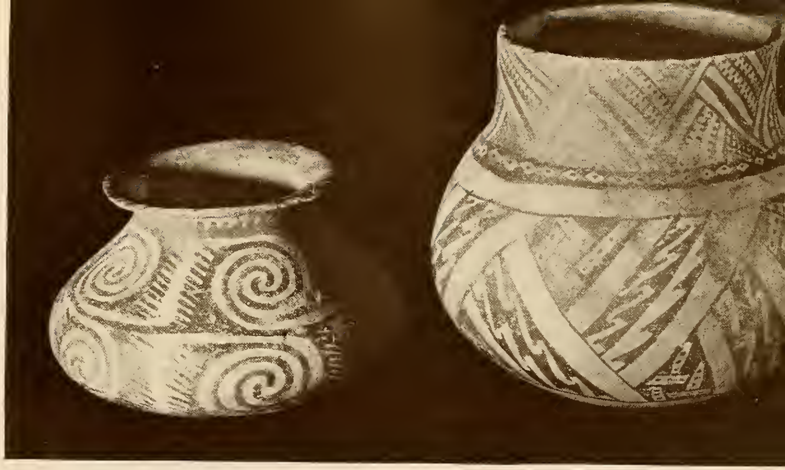
For how long? you ask. Here is where the principle of stratigraphy breaks down, because it does not offer the key to the local historical sequence in relation to the Christian calendar. This must be arrived at by other means.

North and east of the Hohokam domain, in the realm of the Basketmaker and Pueblo Indians, we now have an exact measuring stick in the tree-ring method of dating. This has revealed the ages of such spectacular ruins as Pueblo Bonito in New Mexico, the cliff houses of Mesa Verde in Colorado, and Betatakin and Kietsiel in northern Arizona. The system was developed by Dr. A. E. Douglass, an astronomer at the University of Arizona. It cannot be applied directly to Hohokam remains, because the arid environment there did not provide the right kind of trees. But there is a way out of the dilemma. The Hohokam established contact with their northern Pueblo neighbors and exchanged goods with them. Pottery was the most significant item, because the various types of Pueblo pottery have been dated by the tree-ring method and therefore serve as useful time markers when found at various levels in the Hohokam region. Conversely, distinctive Hohokam pieces occur in Pueblo ruins, so that the archeologist has a two-way check on his efforts to correlate the development of the Hohokam with the known chronology of the Pueblos. In this way, periodic divisions have been assigned to the Hohokam. It must be remembered, however, that

▼ WITH ONLY the most elementary tools of stone and wood, these people constructed an irrigation system totaling 150 miles of canals in the Salt River Valley alone


Phoenix Mountains
Ceremonial Grotto
Petroglyphs
Second Canal System
PUEBLO ULTIMO
LAS COLINAS
Heavy Timber
PUEBLO GRANDE
PHOENIX
DOS CASAS
Salt
PUEBLO DEL RIO
Rough Ground
PUEBLO DEL ALAMO
PLAZA
TEMPE
PUEBLO DEL MONTE
LAS ACEQUIAS
Salt River
PUEBLO VIEJO
Gila River
PUEBLO PRIMERO
CASA DE LOMA
"Hieroglyphic Rocks"
First Canal System
Salt River Mountains
ALTA VISTA
LOS MUERTOS
PREHISTORIC IRRIGATION CANALS OF THE HOHOKAM
After Dr. Omar A. Turney
SCALE OF MILES
0
1
2

➤ POTTERY permits the closest dating of the Hohokam culture, because it can be compared with the styles of neighboring regions where accurate dating has been possible. Measurement of tree rings in ancient timbers enables the scientist to establish a precise time scale based on known fluctuations in rainfall. Neighbors of the Hohokam people used such timbers in building; therefore the Hohokam, who traded with them, can be fairly accurately fitted into the same chronology. The jar at left is known to belong to the Colonial Period (A.D. 600 to 900), that on the right to the Classic Period (A.D. 1200 to 1400)



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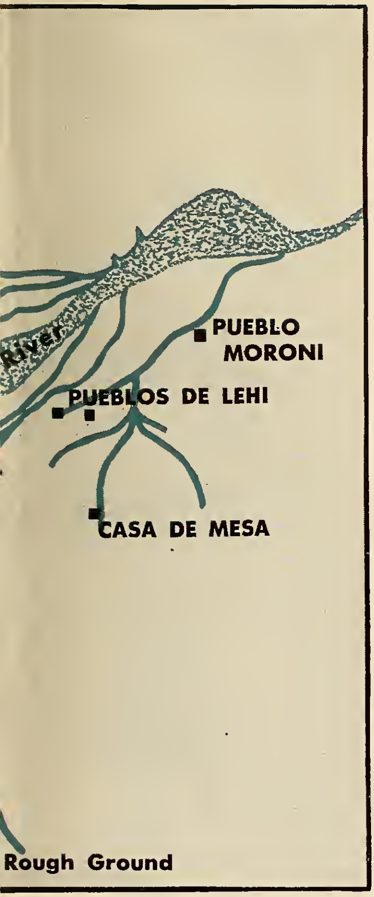
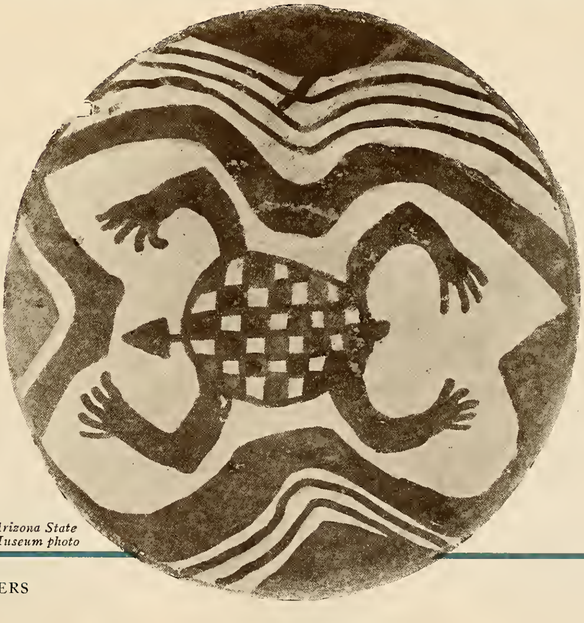


actual dates, particularly the early ones, are assigned only tentatively.

The formative stage of the Hohokam, beginning perhaps about the time of Christ and lasting to A.D. 500 or 600, has been called the Pioneer Period. During this time, the people were developing a new economy and in that sense were pioneering, even if they may not have recently arrived as immigrants. This economy was based on native American plants, notably corn, which had been domesticated somewhere to the south and came to them by the normal process of diffusion. No proof has been found to support the idea that irrigation was practiced at this early time, but I believe it may safely be assumed that a start had been made.

Strangely enough, the partially sunken houses of the Pioneer Period were very large, as much as 35 feet square, and were unmatched in size by any of the later domestic structures. According to some authorities these were occupied communally. The engineering skill required to build

➤ THIS RED-ON-BUFF PLATE with a boldly but poorly drawn figure of an animal, dates from the Sedentary Period (A.D. 900 to 1200)



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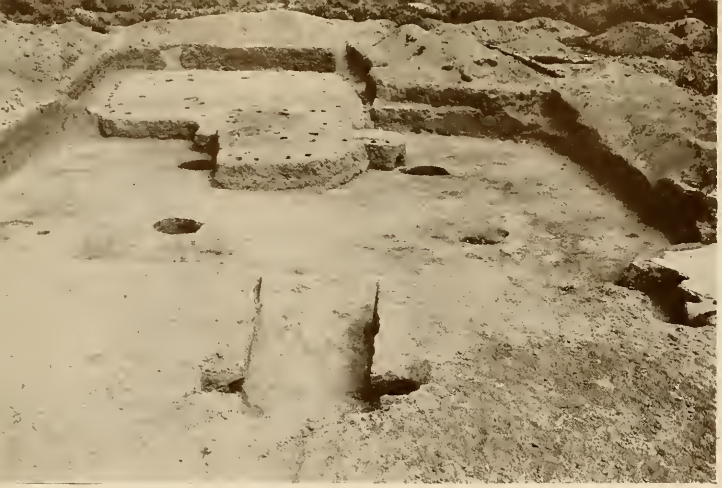


Gila Pueblo photo

▲ **Different architectural horizons.** The square house dates from the Pioneer Period, when the people built their biggest houses. After it fell into disuse, another house was built on the debris, as shown by the raised section

these homes was far beyond any first faltering attempts at house building, and in this we may have an argument that Hohokam history began long before our present information would indicate. In the lesser arts and crafts, the accomplishments were not so marked. Well-made though simple pottery, strictly functional stone tools, a limited number of personal ornaments of shell, and clay figurines about exhaust the list of goods that have survived. The figurines are reminiscent of those found on the Mexican plateau, and the ideology that impelled their making, whether a cult or not, probably reached the Hohokam along with corn from Mexico, about the beginning of the Christian Era.

Efforts to determine the physical appearance of the Hohokam people have been frustrated largely by their custom of cremating the dead, which leaves almost nothing for the archeologist in the way of anatomical detail. No other North American group adhered more consistently to this custom. It was already practiced in the Pioneer Period and continued to be the fashion for perhaps a millenium and a half.

Including the Pioneer Period, a total of four stages are recognized as follows, with approximate dates:

Pioneer Period, A.D. 1 to 600
Colonial Period, A.D. 600 to 900
Sedentary Period, A.D. 900 to 1200
Classic Period, A.D. 1200 to 1400.

During each period there were characteristic achievements. New elements were added, some old ones were lost, and those that survived were constantly modified. The greatest technical and artistic advances came in the late Colonial and Sedentary Periods. Space permits us here only to touch on a few of the highlights.

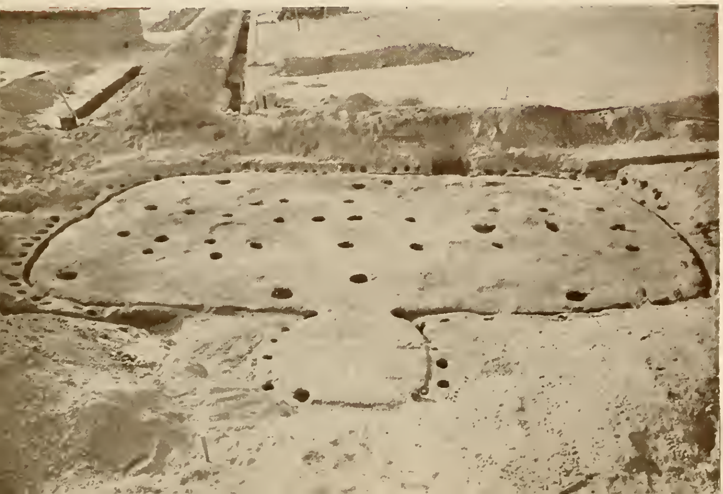
Except for the size of the earlier houses, the Hohokam never distinguished themselves in domestic architecture. They were content throughout their long history to erect a flimsy brush and earth-covered structure over a floor sunken below the desert level—a shallow form of pit house. The shape of the floor varied from time to time from squarish to rectangular to oval, and there were necessary modifications in the type of roof. An architectural sequence has been established, but this makes a poor showing when compared with the multi-storied masonry houses of the Pueblos.

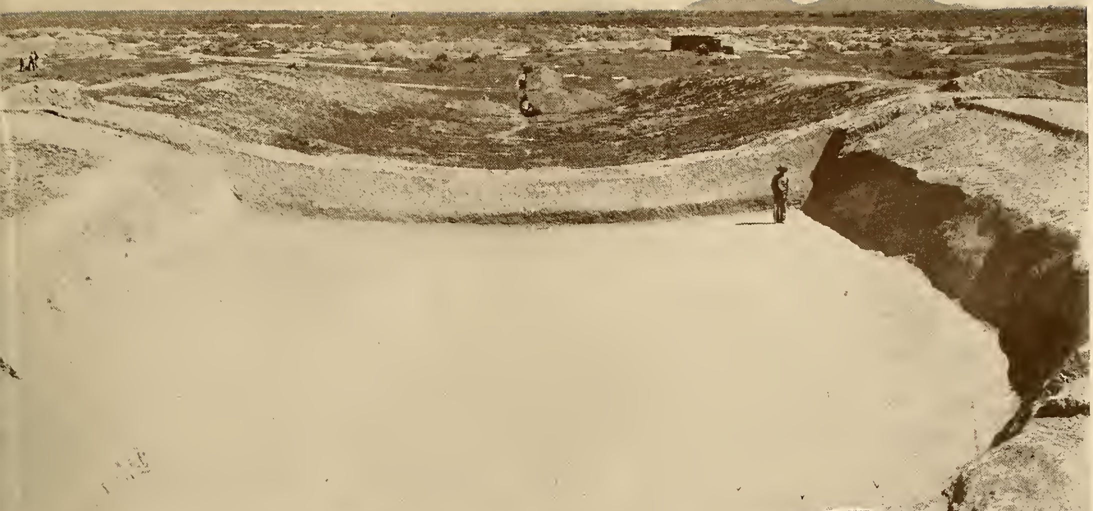
The most preposessing architectural products of the Hohokam—architectural at least in a sense—were the ball courts or game arenas. During the Colonial and early Sedentary Periods these were large, unroofed, oval areas, as much as 200 feet in length, or two-thirds as long as a football field. The floors were sunken well below ground level and flanked by high earth-banked sides. We think that these courts were used for games similar to those played in the more elaborate and professional ball courts of the higher civilizations of Mexico and Central America. In fact, rather specific analogies have led to the speculation that the Hohokam courts were inspired by the older ones in Mexico. By the Classic Period, the ball court had been much reduced in size and, whatever games may have been played there, appear to have lost popular support.

In Mexico and Central America, there is abundant documentary proof that balls made of native rubber were employed in the games long before the arrival of the first Europeans. Of the thousands of rubber balls demanded annually by the Aztecs as tribute from subjugated tribes, not one has survived to the present. Paradoxically, however, one has been found in a Hohokam ruin in Arizona, preserved because it was buried

▼ **Rounded** corners and oval entrance make this house typical of the Sedentary Period (A.D. 900 to 1200)

Gila Pueblo photo





Gila Pueblo photo

▲ **Ball courts** were a conspicuous feature of Hohokam social life during the Colonial and Sedentary Periods (A.D. 600 to 1200). In the Classic Period their size and importance had become much reduced. This one, at Snaketown, measured 175 feet long. Stone markers were set in the floor near each end of it

➤ **A rubber ball**, used in all probability in the playing courts, centuries before the white man had ever heard of rubber. It was still resilient beneath its oxidized surface and was made of native American rubber, unvulcanized and unrefined. Found in a jar near Toltec, Arizona (Sedentary Period)

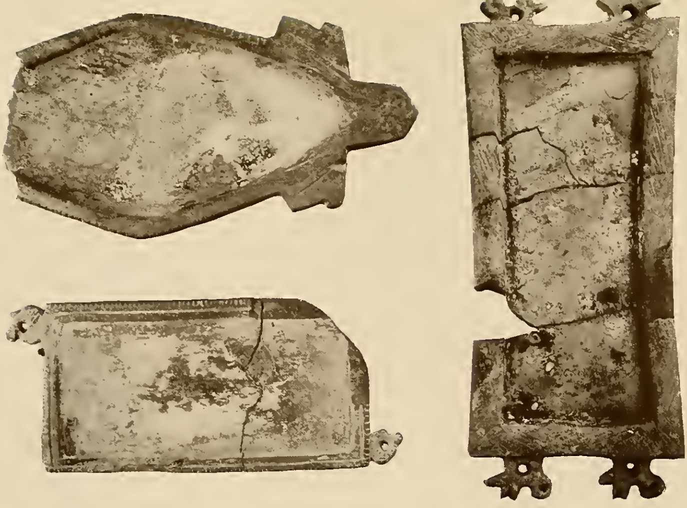
Arizona State Museum photo

in an earthen jar. The age of this ball, judged on the basis of associated material, is the Sedentary Period, or perhaps around A.D. 1100. A chemist's analysis states that the rubber, still resilient beneath the oxidized surface, was of native American origin, unvulcanized and unrefined. No one can say that this ball (or others like it) was used by the Hohokam in the ball courts, but I am inclined to believe that the occurrence of these two features together was more than mere accident.

As among most stay-at-home farming people, pottery was an important feature of the Hohokam household. It ran the full range from plain and often very large cooking and storage vessels to eccentrically shaped containers, possibly of ritual import. The standard decoration was painted in red-brown on a light buff background, which, together with design and vessel shape, readily distinguishes Hohokam pottery from that of other southwestern groups. The Hohokam potter was no precision artist when it came to painting design, yet a certain admiration is evoked by the complicated geometric layouts and particularly by the animation achieved in small life forms by a few extemporaneous strokes of the brush.

Stylistic change in form and design affected Hohokam pottery just as it does tableware in our own culture. This has led to the recognition of a series of nine phases of the potter's art, extending over an estimated 1200 to 1500 years. The ceramic histories of native American people has seldom been traced over so long a period as here.

In sculpturing and carving, the Hohokam made notable strides, though they were still far behind such people as the Toltec and the Maya. All their work was on a small scale and generally in soft materials. Cuplike stone vessels, whose use has not been determined, show carved geometric motifs or high relief figures of desert reptiles and occasionally people. Also characteristic are birds and animals in the full round with a receptacle in the back in simple and not too realistic execution. Rectangular palettes of slate with raised incised borders are an inevitable accompaniment of Hohokam ruins. These usually come to light with the cremated ashes of the dead, and the conjecture that they had some ritual meaning may not be far from wrong. Traces of pigments suggest actual use of paint palettes, doubtless for decorating the body. Curiously, many of them reveal incrustations of lead compounds and even metallic lead. The heat generated by the pyral fire, through which these objects passed,



Los Angeles County Museum photo

▲ SLATE PALETTES are found frequently in Hohokam cremations. Sometimes they have marginal decorations of birds and snakes and occasionally of desert reptiles. All of these had passed through crematory fires. The heat had sometimes reduced the incrustations of lead compounds, which were possibly used as pigments, to a metallic state. The people, however, appear to have been completely unconscious of their metallurgic feat. (Colonial Period)

was great enough to reduce the mineral to a metallic state. But the Hohokam appear to have been completely unconscious of their metallurgic feat, as the use of lead was never exploited.

Any account of the Hohokam would be incomplete without due acknowledgment of their fondness for ornaments made of sea shells and of the high skill developed by their craftsmen in making them. Most of this material, in a raw state, was imported from the Gulf of California by human freight-carriers over the desert of northwestern Mexico and southwestern Arizona. Both univalve and bivalve shells, representing several scores of species, were used. The natural shape was exploited for finery of distinctive types. Smaller univalves could easily be changed to beads by grinding off the spires. Larger ones, as the *Conus,* were readily transformed into spangles, and the nearly circular shell of the *Glicymeris* was ideal for bracelets and rings. But where the shellwork assumed its truly distinctive quality was in the carving of pendants in effigy of desert creatures, as the rattlesnake, lizard, frog, and bird, and also in the carving in relief of snakes and birds on bracelets and rings. In the latter a favorite motif was two birds, back to back, each engaged in swallowing a snake, the bodies of which intertwined to form the band of the ornament. Mosaic shell overlay was also known, but productions of this sort have survived only in the most fragmentary form.

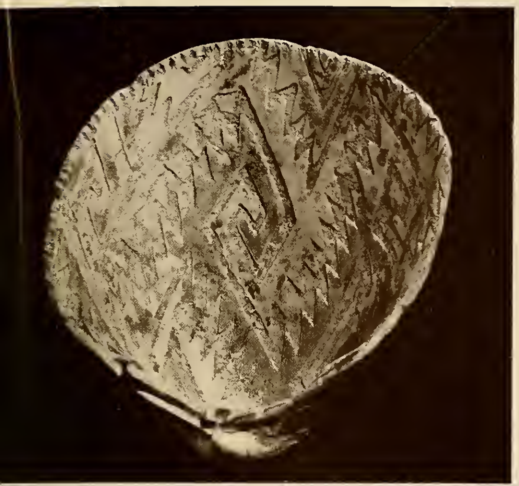
The fame of Hohokam shell carving traveled far and wide, even during their own time, for objects undoubtedly made by these people reached the distant tribes in the southwest. Indeed, archeologists have strongly suspected that the Hohokam, being near the source of supply, were mainly instrumental in dispersing shell over this area.

Shell artistry reached its peak among them when some creative or observant soul invented a method for etching shell. This took place perhaps in the eleventh or twelfth century. We do not know, of course, just what the process was, but the same results have been achieved in laboratory experiments by using only the materials available to the Hohokam. The chemistry of the process is simple, as the nearly pure calcium of the shell is readily attacked by acids. In the test a corrosive was eventually derived by fermenting the juice extracted from the fruit of the giant cactus, making a weak acetic acid. The next step was to cover portions of the shell with an acid-resisting material, pitch. The unprotected parts were thus subject to chemical action when the piece was immersed in the acid. A 72-hour treatment duplicated the effect achieved by the Hohokam, detail for detail. An accompanying figure shows one such piece, with geometric pattern, further strengthened by additions of green and red paint. It epitomizes this unique form of art, unmatched anywhere in the world up to this time, so far as I have been able to learn. The earliest record of etching in Europe is on armor dating from the mid-fifteenth century. Perhaps because the technique was difficult to control, shell etching was short-lived, as the abundant shell remains from Classic Period sites retain no trace of it.

That the Hohokam were in contact with the high civilizations far to the south in Mexico is attested by a number of objects that have been unearthed in early southern Arizona villages. Indeed, it seems altogether probable that much of the stimulus for their cultural advances came, directly or by circuitous routes, from that source. This began originally with the northward spread of corn about the beginning of the Christian Era, and it may also be reasoned that the art of making pottery and figurines from clay arrived at the same time. From then on, the Hohokam placed their special stamp on such accessions. The small human figures of clay were present in all periods, although they lessened appreciably in numbers by the Classic Period, and stylistic changes are traceable just as

▼ A SLATE PALETTE with simple incised border. (Sedentary Period)

Arizona State Museum photograph

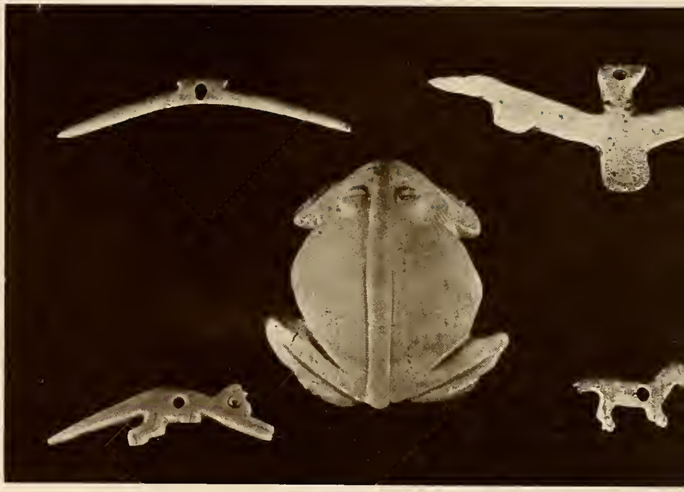


Arizona State Museum photo

▲ **Etching** before Europe knew the art: a large shell (*Cardium elatum*), the inner surface of which is decorated with a design eaten away by acid. The pattern is further accentuated by additions of red and green paint. The effect has been duplicated today by use of vegetable juices known to the ancient people. The earliest etching in Europe is from the fifteenth century. This example, found near Tucson, dates from the period between A.D. 900 and 1200

Arizona State Museum photo

▲ A **large conch shell** trumpet used by the Desert Hohokam of the Classic Period

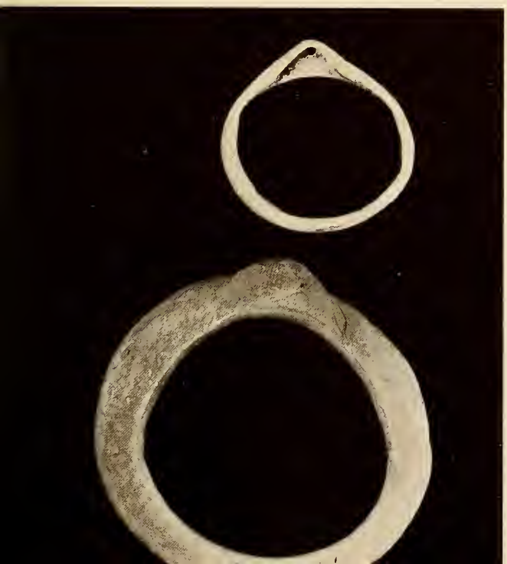


Arizona State Museum photo

➤ **Shell pendants** carved in varying degrees of realism. A lively industry in shell ornaments of this sort distinguished the Hohokam culture and made its influence felt far beyond the boundaries of the tribe. Most of the shells were brought from the Gulf of California by human freight carriers

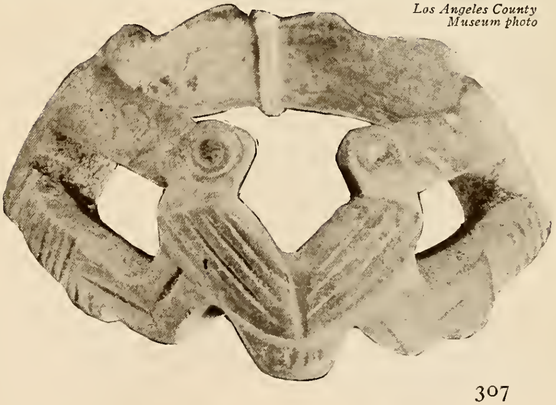
▼ **Bracelets** were the commonest shell jewelry. The thin fragile type (*above*) was, in general, earlier than the heavy standard form (*below*)

Arizona State Museum photo



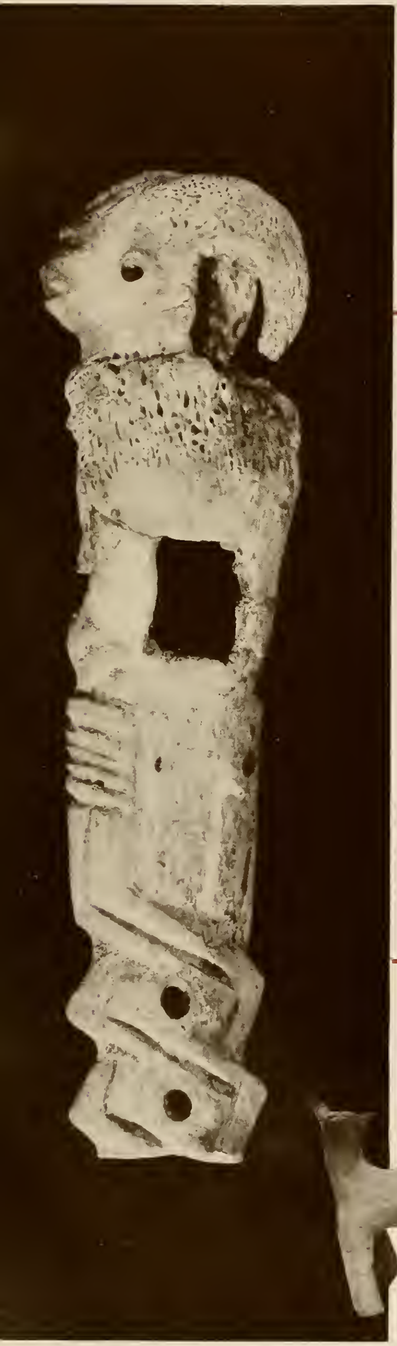
▼ **Two birds** back to back and each swallowing a snake, formed a favorite motif, as illustrated here by a carved shell ring

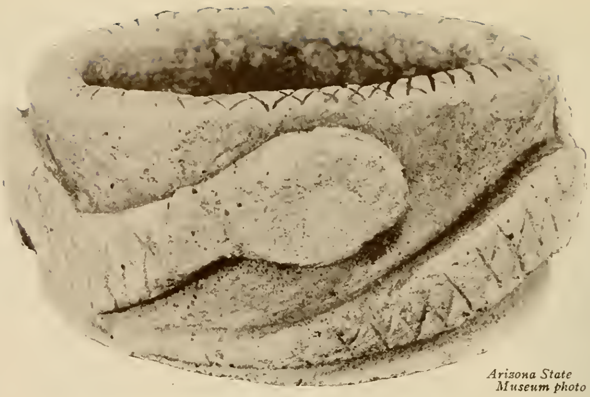
Los Angeles County Museum photo



▼ THIS HEAD of a mountain sheep was carved in a leg bone of a deer by a River Hohokam of the Colonial Period. The piece is about two inches long. (Grewe Site)

Los Angeles County Museum photo





Arizona State Museum photo

▲ A SMALL STONE VESSEL with snakes in high relief: a product of the River Hohokam people of the Colonial Period

they are in Mexico. The ball court is another clue to southern contacts, going back perhaps as early as A.D. 600 to 800.

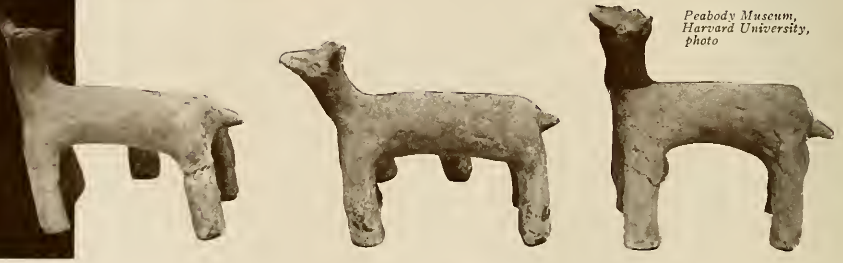
Some objects are unmistakably direct importations, brought north by traders or traded from group to group and acquired from neighbors. I am thinking particularly of the mosaic plaques or mirrors, and copper bells. The plaques consist of stone discs, one face of which is covered with an expertly fitted mosaic of thin iron pyrite sheets. The other face is decorated with heavy-bodied pigments in a technique resembling, but not duplicating, cloisonné. Examples found in Arizona, though heavily damaged by crematory fires, are indistinguishable from those recovered in Yucatan and as far south as Guatemala. It is improbable that anything as intricate and complex as these mirrors should have been thought out independently by the Hohokam.

Bells of cast copper, resembling the familiar sleigh bell, are the only metal objects of consequence that reached the southwestern United States prior to Spanish times. These came to the Hohokam and their Pueblo neighbors to the northeast possibly as early as 1100 but mostly a century or two later. Here again the case for importation seems clear. Nothing yet found indicates metallurgical knowledge among the southwestern Indians before the Spanish Conquest, and exactly similar bells are found in great number in such places as the State of Michoacan in Mexico.

Trade goods from Mexico, such as we have been mentioning, may in time even permit a correlation of Hohokam and Mexican chronologies.

The term "Classic Period" is perhaps misleading, since the summit of Hohokam progress had been passed and the culture was going into decline. But a significant event characterizes the period—the arrival of a new people, the Saladoans, a branch of the Pueblo folk. This immigration

▼ PART OF A HERD of clay animals found by Frank Hamilton Cushing in the Salt River Valley in 1887. Their resemblance to the guanaco of South America caused Cushing to call the ruin "Los Guanacos;" but the creatures are probably deer. Average length, 5 inches



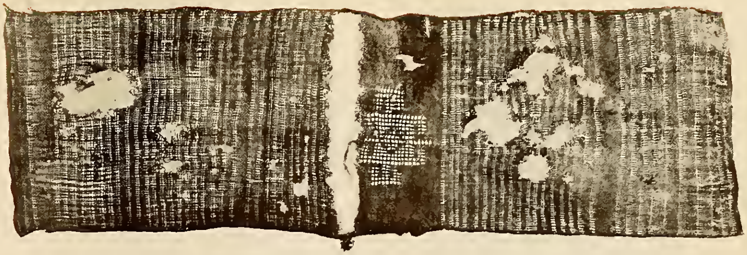
Peabody Museum, Harvard University, photo took place, according to the best judgments, about 1300. A host of features, previously foreign to the Hohokam, were introduced. Among them were thick-walled adobe buildings with many rooms and several stories, the custom of burying the dead instead of cremating them, and pottery decorated in red and black.

It would appear that this meeting of two distinct groups in the Gila and Salt River Valleys was an amiable one. Particularly along the Gila, the indications are that these groups lived on friendly terms in the same villages and shared the responsibilities of keeping the irrigation system functioning and the crops coming in. This situation prevailed for several generations when, for reasons that are not yet clear, the Salado contingent moved away. In round numbers this took place about 1400.

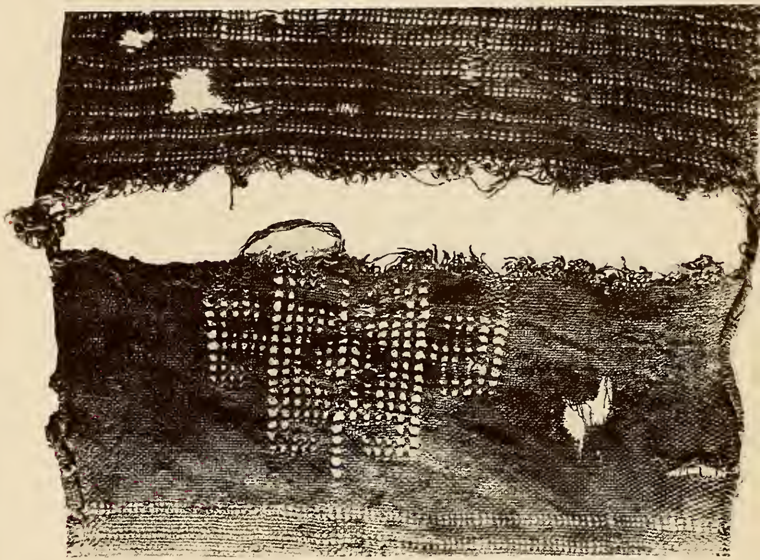
The preceding comments all refer to the remains of the Hohokam found along the rich valleys of the Gila and Salt Rivers. It was here that the culture rose to its greatest height and the members of the social body extended their greatest efforts for the common good in the construction of irrigation systems. These were the River People. But not all of the Hohokam lived in such fortunate surroundings. To the South, in what is now the Papago Indian Reservation, lived their kinsmen, the Desert People. Among them, scarcity of surface water meant that tillage was restricted to a few favorable spots, and natural plants, like the saguaro cactus, were much more important. Nevertheless, supreme efforts were sometimes made to catch run-off waters after sharp seasonal rains in the hills and direct them by hand-dug ditches to the fields far away. One of these, identified first from the air, is ten miles long and was apparently used in the fourteenth century.

The rigors of environment were felt here in other ways, too. There were few if any large towns, because the food resources would not support them. And the arts and crafts were esthetically only a faint echo of those of the more fortunate River People.

The history of the Desert People, as traced by the Arizona State Museum, begins likewise roughly at the time of Christ. Their record adds a good bit that we would not otherwise know about the Hohokam, for the Desert People left their remains in at least one locality where extreme dryness preserved many articles that



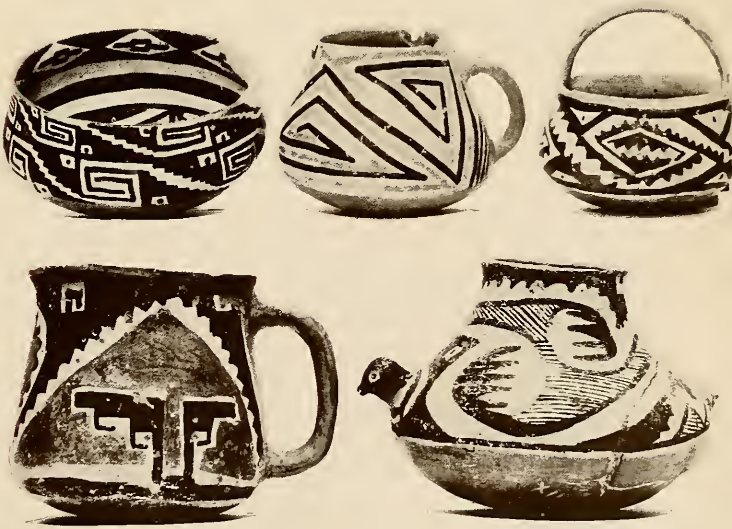
Two views of a cotton poncho for a child, belonging to the Desert Hohokam. From the eleventh or twelfth century



Arizona State Museum photo

▼ The so-called Salado people, who entered the domain of the Hohokam around A.D. 1300, used pottery of this type, in red, black, and white. They apparently were friendly visitors and for a few generations shared with the River Hohokam the responsibilities of keeping the irrigation system in order

Peabody Museum, Harvard University, photo



would normally have perished in the exposed village sites of the River People. Handsome cotton textiles, baskets, robes of rabbit fur, sandals, and a host of other things have thus been preserved. They were certainly known to the River People, too, but were almost completely erased by their crematory fires or by the elements.

After about A.D. 1000, the Desert People appear to have changed their burial custom from burning to earth burial. Some 40 burials from this valuable site, Ventana Cave, give us for the first time some notion as to how these people looked. We can characterize them simply as of medium structure, with skulls that do not seem to differ greatly from those of the Papago Indians, who have been known in this same area since Father Eusebio Kino discovered them in 1698. Indeed, this is strong reason to believe that the Desert People of a thousand years ago are still with us, in the shape of this enterprising modern tribe.

The mummies of Ventana Cave tell us more: how the people dressed and how they wore their ornaments. In colder weather, they wore a blanket of rabbit fur or woven cotton, but otherwise a breech clout sufficed in this sun-baked area. The fashion in personal decoration is illustrated well by an adult male who wore disc-shaped shell pendants hanging from his ears and a wooden cylindrical plug skewered through his nasal septum.

What may be called an early American version of the Maginot

Continued on page 335

Arizona State Museum photo

▲ VENTANA CAVE, once occupied by the so-called Desert Hohokam, yielded valuable new evidence regarding more perishable objects. Protected from moisture and the elements in a way that was not possible in the damper sites of the River people, textiles, baskets, and robes of rabbit fur were preserved here. Skeletal remains also were found, giving evidence of the physical appearance of the Hohokam people

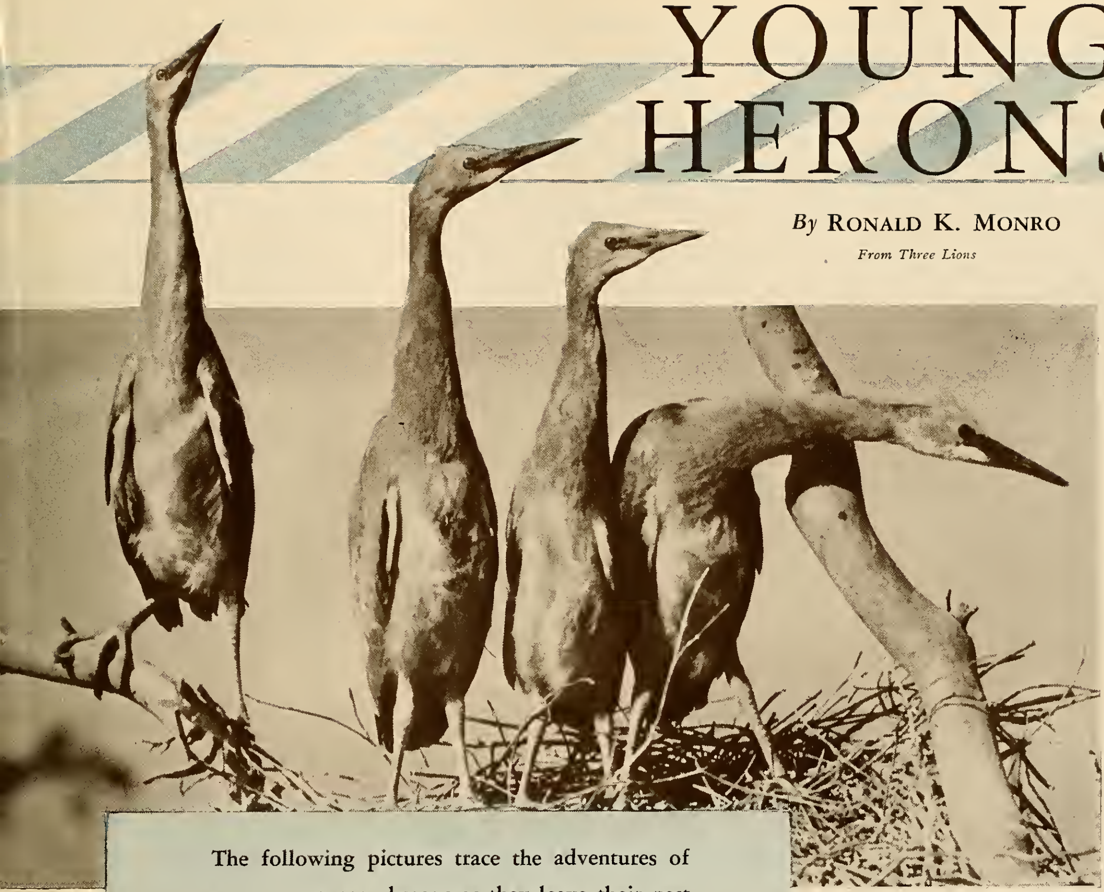
▼ THICK-WALLED ADOBE BUILDINGS were an innovation brought in by the Salado people, as seen here in the ruins of Casa Grande, about 40 miles southeast of Phoenix. But for reasons that are not clear, they moved away after several generations. And the Hohokam culture itself, with its elaborate system of irrigation, became inactive about 1400

Photo by George A. Grand; courtesy, National Park Service

YOUNG HERONS

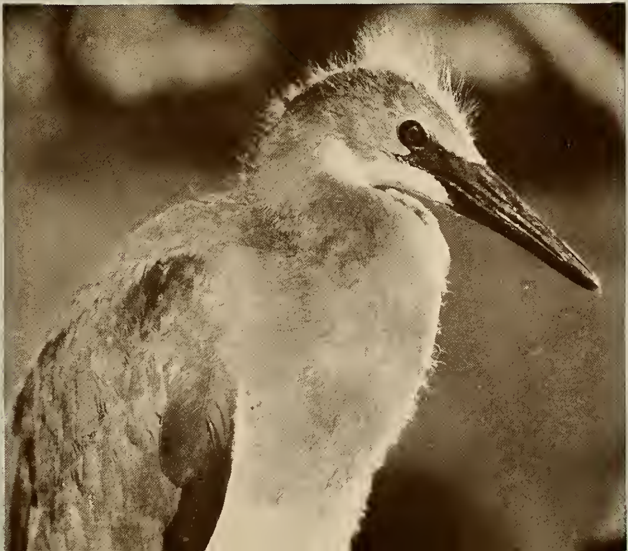
By Ronald K. Monro

From Three Lions



The following pictures trace the adventures of some young gray herons as they leave their nest in Australia. They have lived high in a gum tree overlooking a swamp in South Gippsland, Victoria

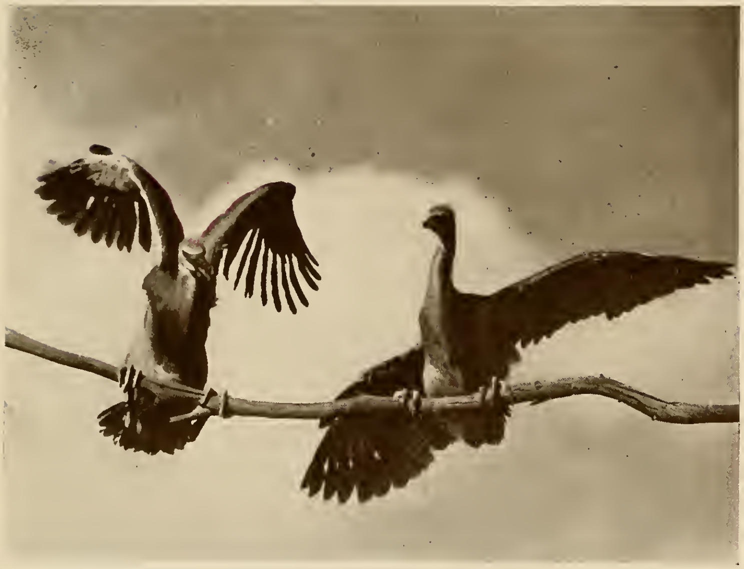
▲ Four of a kind: the heron quadruplets on their flimsy nest of sticks in the fork of a gum tree. When danger approached, they all "froze" into various attitudes and stayed perfectly still until the intruders had gone



◀ Pensive. A young white-faced heron quietly sits and awaits more food to be brought by its graceful parents. Note the baby down still adhering to its new feathers on the head and breast

1

▼ Trial flight. Long before they could fly, the baby herons spread along the limbs of their nursery tree and flapped their wings vigorously, going through all the motions of flight

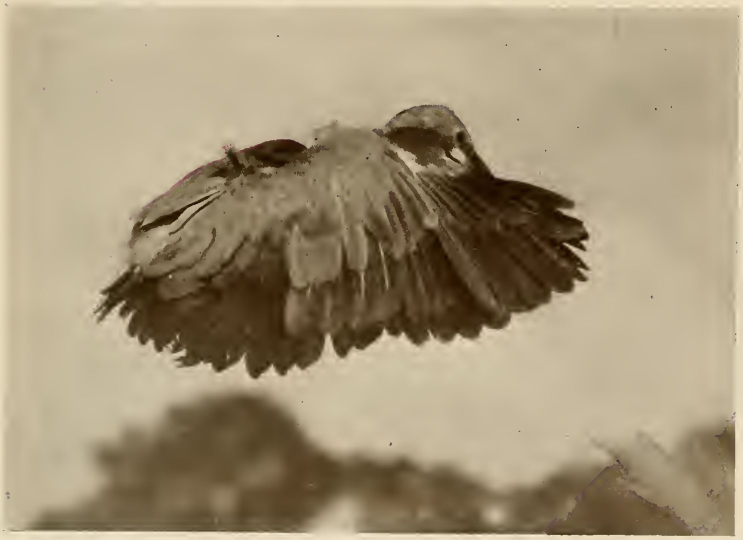


2

▼ Take-off. First flight of young heron caught by th magic eye of the high-spee

4

▼ Flight. At the completion of the wing beat, the feet are drawn up into the body, the head is folded onto the breast, and the wing feathers almost touch at the tips



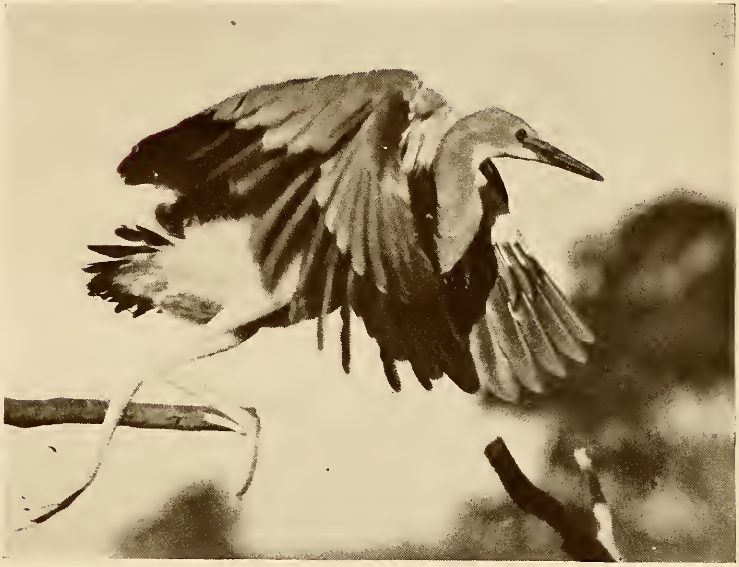
5

▼ Reinforcements. A young heron sees a frog hop beneath some rushes. One of the others comes down and helps to hunt for it

camera. Here the young bird spreads wide its wings and springs from its perch

3

➤ AIRBORNE. Once in the air, the bird beats its wings down with a powerful sweep and gathers up its lanky legs beneath its streamlined body as it starts to fold its graceful neck onto its breast

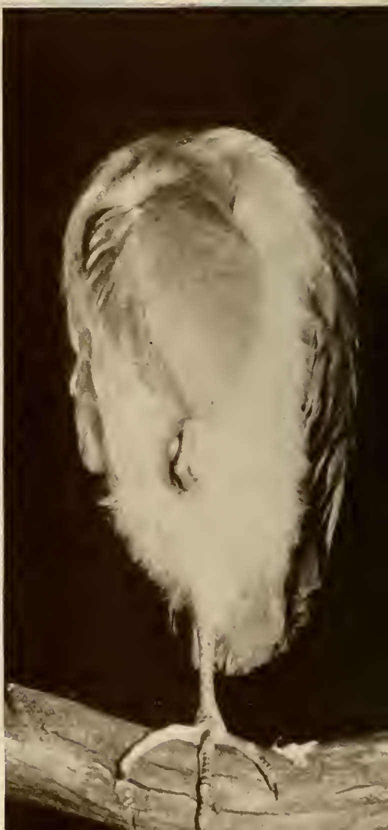


➤ ESCAPE action has been successfully taken by the frog and although the two young herons hunt diligently, they can find no trace of their hoped-for meal

6

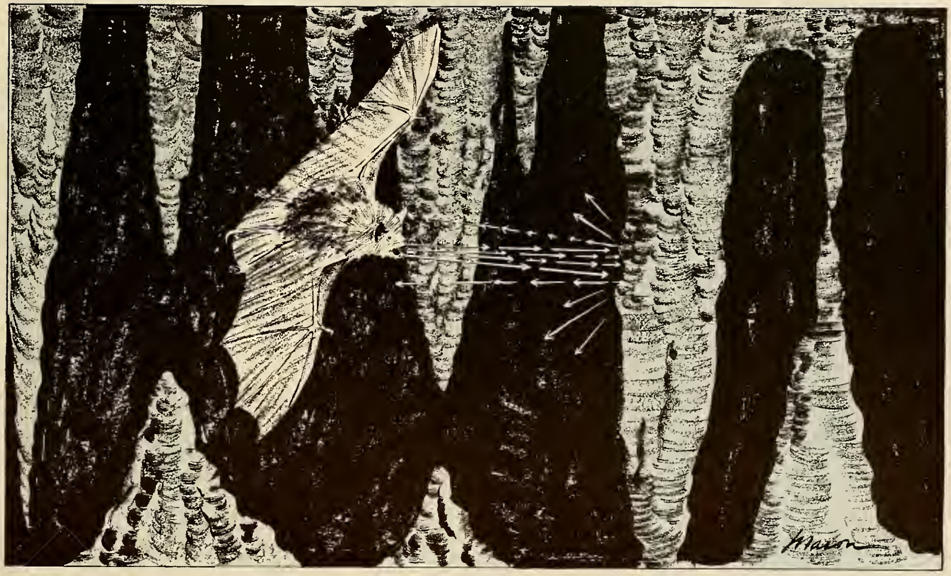
Drying. A wet tail and no frog was the reward of the inexperienced hunters

◂ Sleep. After an exciting day, the young heron was ready to enjoy a good sleep



➤ Tucking its head over its wing and under the back feathers, the bird draws one leg into its breast feathers and sleeps soundly. During the night it changes legs from time to time. Tendons working automatically ensure that the grip is maintained during sleep

"BAT RADAR"



By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

In the postwar world, pilots of commercial airplanes will have radio instruments that will determine accurately the position of obstacles and their distances from the plane, as well as the altitude of flight and the physical conformation of the surface of the earth below. These radio detection devices, or radar instruments, function as well in fog and bad weather as they do in clear weather.

The public has been given enough information on radar to understand the general principles involved: Radio impulses are beamed out into space, and when any solid object is encountered, an "echo" rebounds. This echo is received by a detector which indicates the direction from which it comes and the time required for its return. Since radio impulses travel with the speed of light, approximately 327 yards per microsecond (a millionth of a second), it is possible to compute accurately the distance the beam has traveled, half of which is the distance of the object.

Bats, the only mammals that can truly fly, use a similar method for avoiding obstacles in their darting flight. Instead of radio impulses, they emit a series of intense cries, pitched too high to be heard by the human ear, and they are guided by the echoes that their sensitive ears are tuned to hear. For generations, the ability of bats to make their way through the inky darkness of winding caves puzzled naturalists. More than 150 years ago an Italian scientist blinded bats and found they could fly as skillfully as ever. While their sight is far keener than usually believed ("blind as a bat" is one of our false proverbial sayings), these experiments proved that they did not depend on their eyes. Some years later an investigator found that if the ears were plugged, the flying skill of a bat was greatly impaired. This discovery was forgotten for many years, and naturalists almost without exception accepted an untried theory that special senses in the skin of the wings were responsible for the ability of bats to fly without hitting things.

In recent years,* however, bats and their flight were studied anew. A number of experiments showed that they had extremely keen hearing, especially for high-pitched sounds. With sensitive recording devices it was discovered that bats give forth a series of strong sounds, pitched far above the limit of our hearing—45,000 to 50,000 vibrations per second, as compared with our limit of about 20,000.

A soundproof room was divided by a hanging screen of metal wires, set about a foot apart. Bats were temporarily blinded and then made to fly through the wire barrier. Blind bats were as successful as normal bats in this test, confirming the old experiments. But when the bats were gagged so they could not make their sound, or when their ears were plugged so they could not hear it, they had great difficulties. They would not fly without much urging, and when they were forced to fly they went slowly, as if uncertain of themselves, bumping into the wires and even the walls again and again, unable to adjust to the unusual situation.

Blind persons make a similar use of echoes to avoid obstacles. The tapping of a blind man's cane along the sidewalk and the resulting echoes have been widely used for generations as a guide when sight could no longer serve. Studies of the problems of "echolocation," as this method has been called, are now in progress, and improvements in technique may be expected which will add greatly to the well-being of sightless persons.

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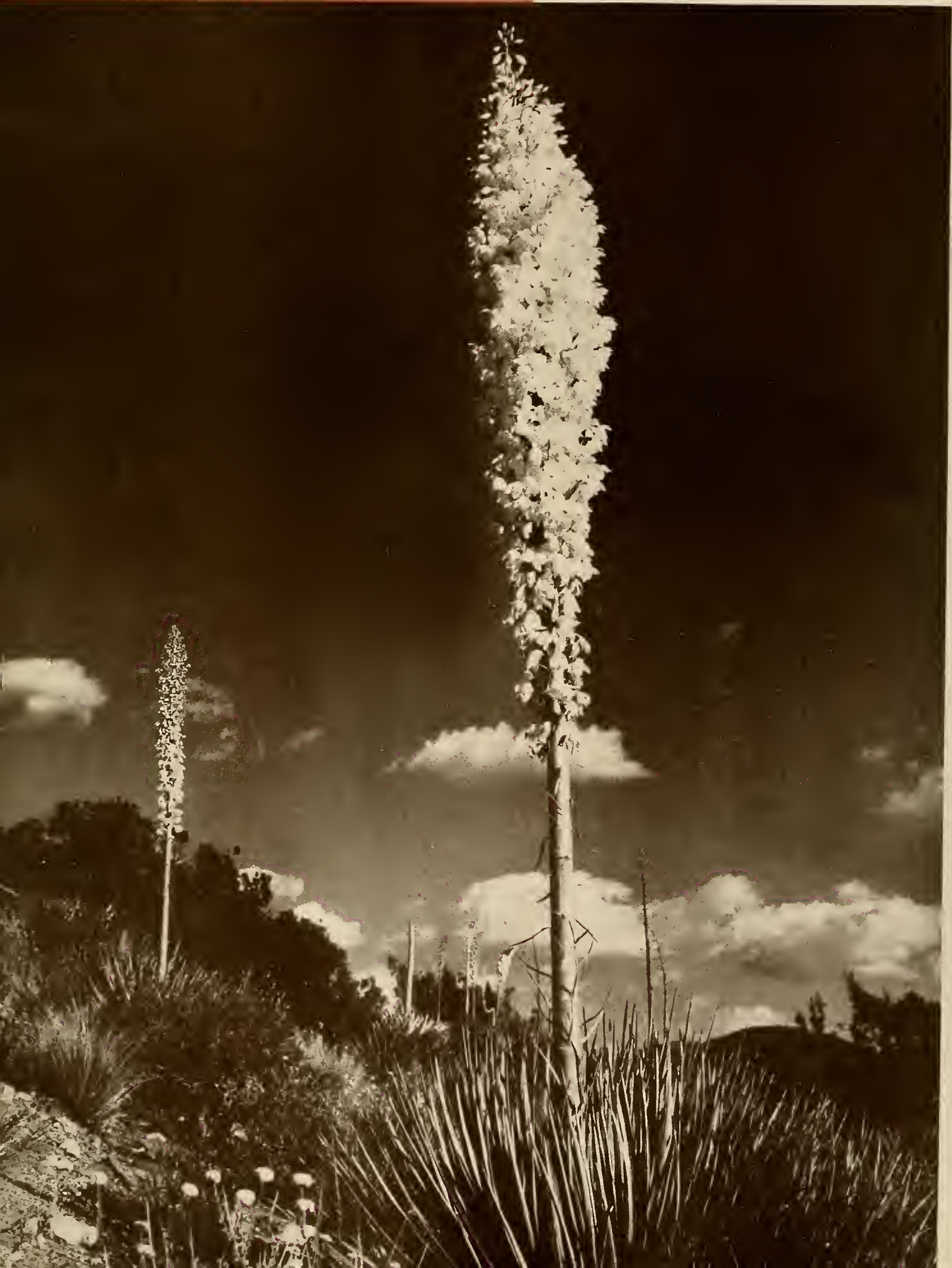
* Griffin and Galambos, *Journ. Exper. Zool.*, LXXXVI (1941), 481-506; *Sci. Monthly*, LVI (1943), 155-162.

▼ THE "CANDLE OF GOD" blooms luxuriantly in the late spring. The creamy-white blossoms stand out brilliantly against a dark sky, as the late afternoon sun sends its last beams of light over the desert

Candle of



GOD

By
CATHERINE AND
DICK FREEMAN

Out on the desert wastes, this tall and stately plant plays a curious game of existence with a tiny moth — and neither could survive without the other

IT is late spring in the chaparral of Southern California when the "Candelaba de Dios," or Candle of God, as the early Californians called it, thrusts its way rapidly upward like a giant asparagus from a "bristling hemisphere of hostile bayonets."

The first warmth of early summer has begun to bring out an aromatic fragrance from the growth in every dry arroyo and mountainside. In rapid succession one after another of these giant stems shoots skyward until finally the desert vistas are transformed into a beautiful flower garden extending ofttimes as far as the eye can reach.

At the rate of nearly a foot a day the stems push their way up to a height of some eight to fifteen feet, depending on favorable conditions. For two or more years the fiercely bayoneted plant has been living in its dry habitat preparing for its magic-like rise into ravishing beauty. No ugly duckling ever becomes a swan as rapidly as this beautiful plant.

The creamy, waxen flowers of the *Yucca Whipplei* hang in dense profusion, from hundreds to even thousands of blossoms on a single stalk. As one passes among the "forest" of stems, their heavy fragrance fills the air and is as alluring to man as to insects.

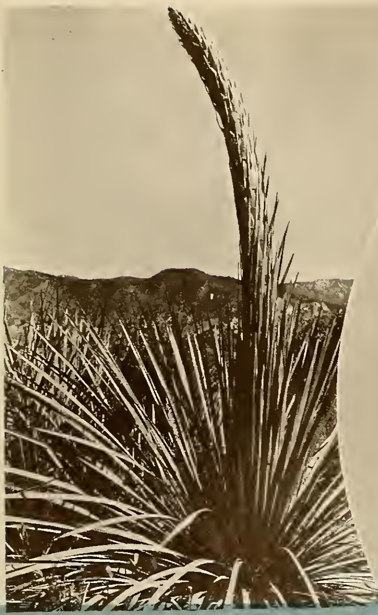
The plant owes its name to Lieut. A. W. Whipple, leader of a surveying expedition sent to the Pacific coast in 1853-54. Dr. J. M. Bigelow, botanist on this expedition, was the first to collect specimens, and Dr. John Torrey, when classifying them later named the plant for Lieut. Whipple. The Navahos, according to research by Charles Francis Saunders, called the plant *yabi-tsa-si*, which literally means "yucca of the gods." The Spanish Californians had two names for it, *quiote*, probably from the Aztec name *quiotl* for the flowering shoot of the maguey plant, and "Candelaba de Dios" or Candle of God, a most poetic and delightful name.

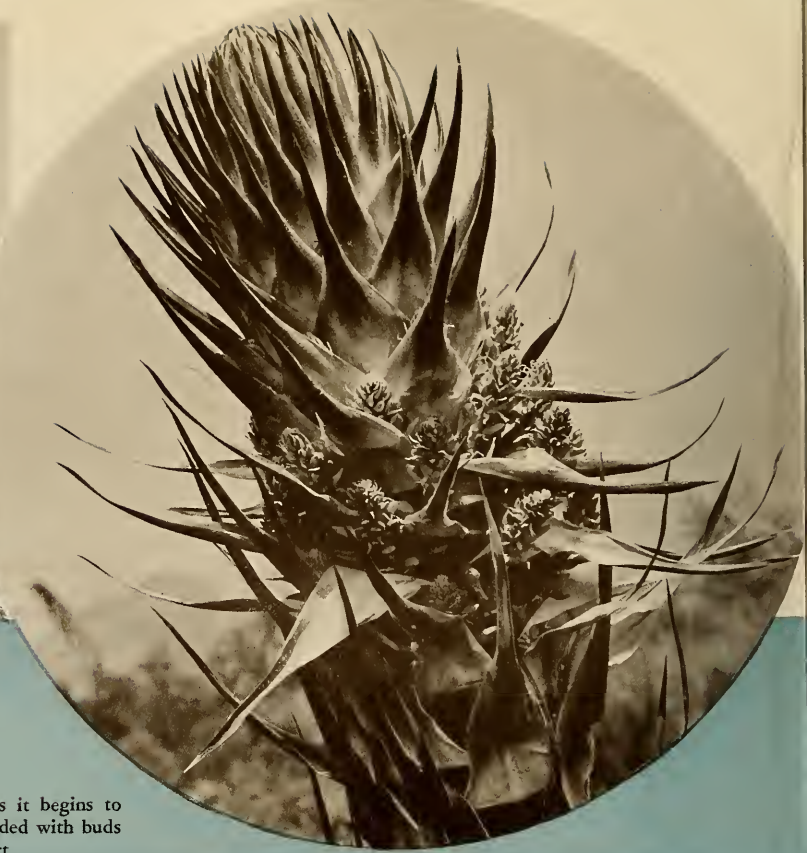
The plant ranges from the edge of the Mojave Desert south through the San Diego country into Lower California in Mexico, extending from low elevations to around 5000 feet in altitude.

It was used by both Indians and early Californians for food, the young tender flower stalk being boiled,

AFTER living for two or three years without flowering, the yucca plant's leafy rosette suddenly sends forth a tender young shoot

THE YOUNG SHOOT grows rapidly, sometimes as much as a foot in 24 hours. Now it is taking on the shape and appearance of a large stalk of asparagus. Its colors are truly exquisite, ranging from a light green to a bluish-purple and rose



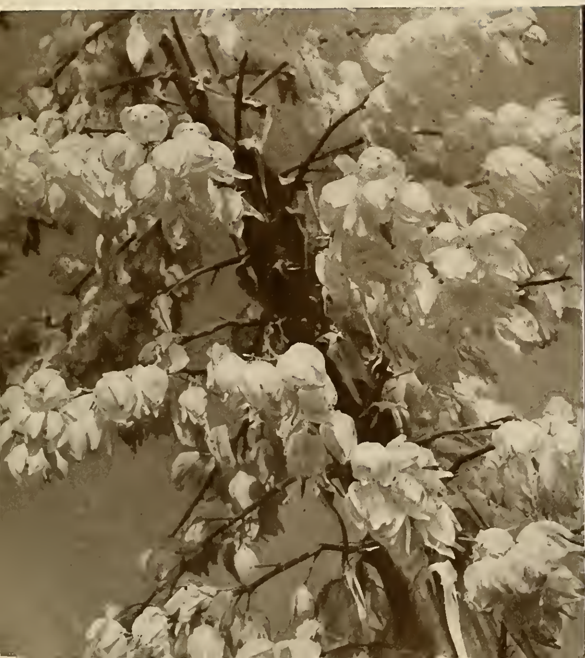


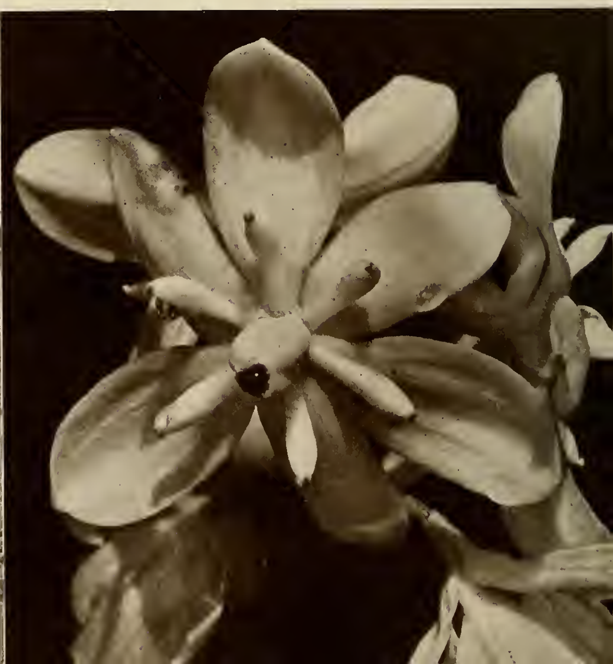
▲ THE YOUNG FLOWER STALK is now several days old and six or seven feet in height. The tip is about ready to break out in little clusters of buds

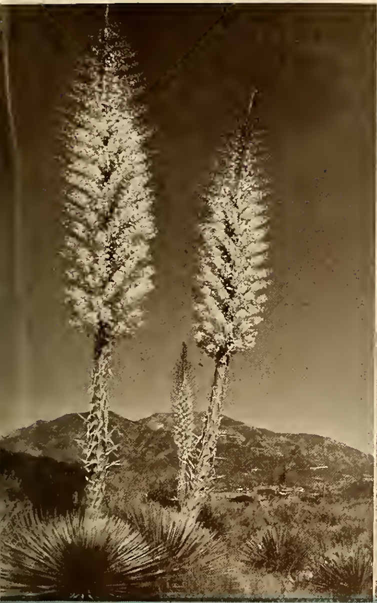
↗ A CLOSE-UP of the stalk as it begins to open out. Little branchlets loaded with buds appear at the base of each bract

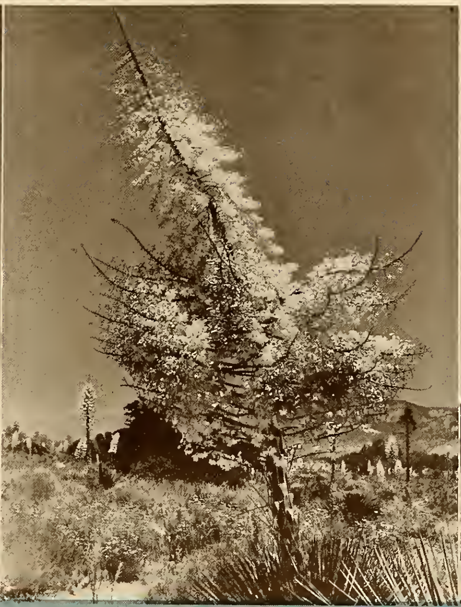
▼ THE beautiful yucca blossoms photographed at their most luxuriant stage

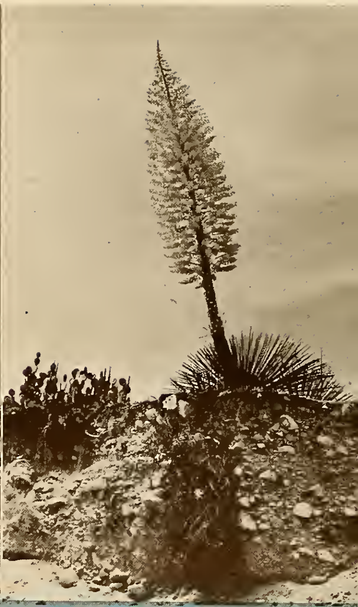
▼ AN INTERESTING VIEW of the yucca flower, magnified to show the detail and texture of a delicately modeled blossom











▲ Now the young branchlets have grown out from the stalk six to twelve inches, and the buds have blossomed forth into the beautiful creamy-white flowers. At the top, the stalk is still shooting skyward, and the buds have not as yet opened

▲ This plant is by far the most beautiful yucca the writers have ever seen. Apparently the stalk was damaged or affected in some way so that the branchlets grew horizontally outward two to three feet instead of the usual eight to twelve inches, making a veritable tree. The trouble, however, seems to have become quite suddenly repaired, for the upper part of the yucca grew as all yuccas are supposed to grow

▲ Here is shown the root system of the yucca as exposed by nature along the bank of a sandy wash. The roots are seen to go straight down as deeply as possible in their diligent search for water, instead of spreading out as many plants do

▼ Usually by late July or early August the flowers have faded and green pods have taken their places. These pods average from one to two inches in length, varying with the locality. As the ovary or pod develops, it lifts itself into an upright position on its stem

➤ By fall the pods have dried, become brittle, and started to lose their seeds. The stalk now rattles in the breeze, no longer the beautiful exotic plant it once was. Now and then a pod will suddenly pop open and scatter its seeds on the ground around the base of the plant

▲ The tiny moth without which there would be no "Candelaba de Dios," and whose life, in turn, would end without this plant

roasted, or baked. A favorite method was roasting in a pit. The pit was excavated, filled with dry wood, and burned. When the fire had burned down to ashes and cooled a little, the stalks, cut to proper lengths, were put in the ashes and left to cook until cold. This was called *quiote tatemada* by the early Spanish Californians. Sometimes the stalks were roasted like potatoes in outdoor ovens. The Indians used to boil and eat even the flowers, while the seeds were ground to use as porridge.

From the fiber of the plants the Indians also made nets, ropes, and saddle blankets. The leaves were soaked in water, then pounded until the fleshy pulp was largely removed. The fibers were then combed and twisted into strands for weaving.

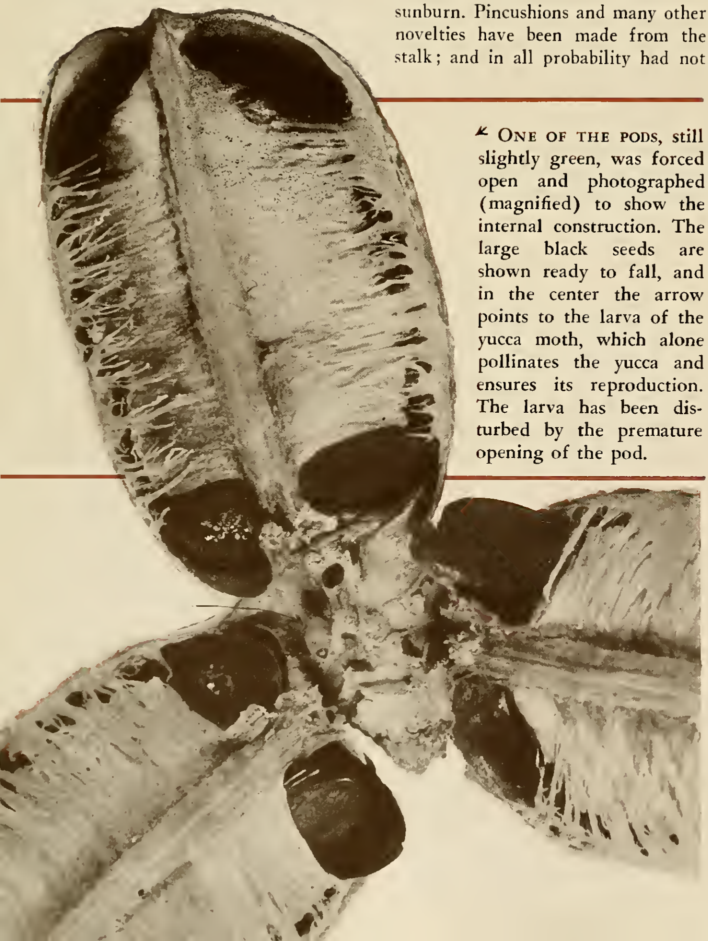
The roots in their turn were very useful, as they contain enough saponin to make a soapy mixture for washing clothes. Perhaps they don't yield the very frothy consistency that we like in our washing tubs, but the Indians didn't have our soap.

Recently the light wood of the dry yucca stalk has been used in making small model airplanes such as are used in the classroom. Sheets cut from the pulpy stalks have also been used to protect young trees from rodents and sunburn. Pincushions and many other novelties have been made from the stalk; and in all probability had not laws put a fine on the destruction of the yucca, its numerous uses would ultimately have spelled its extinction.

The unusual way in which the plant is pollinated by the moth *Pronuba yuccasella* has brought much attention to the yucca, and justly, for it is a fine example of plant and insect interdependence. Owing to the construction of the yucca flower and the fact that the pollen is too glutinous to be borne by the wind, fertilization without the aid of this insect can take place only by the merest accident. So if it were not for the moth there would be no yuccas. On the other hand, if it were not for the yucca there would be no moths; for this particular moth, which fertilizes only the Candelaba de Dios and perhaps other closely related yuccas, lays her eggs nowhere else.

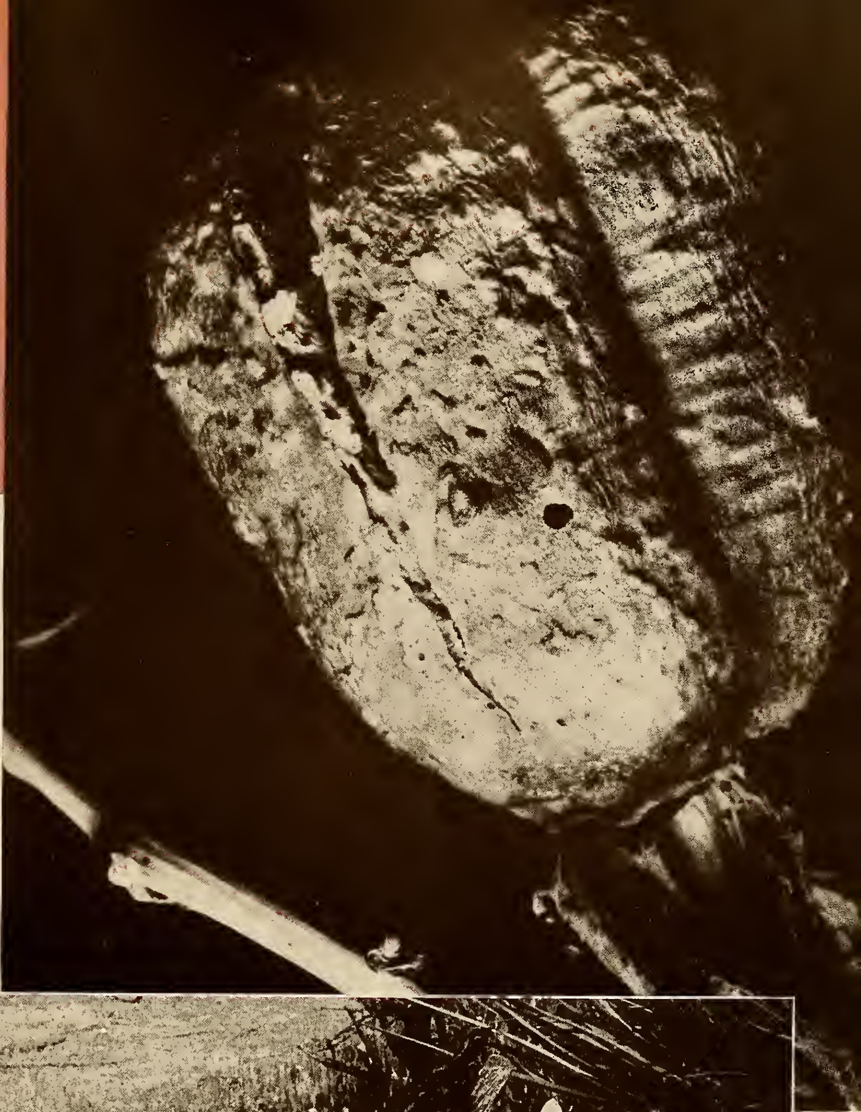
After collecting the pollen from numbers of anthers, she forces her ovipositor into the swollen seed-bearing base of the pistil, known as the ovary, and lays several eggs. After this operation, she ascends the pistil and deposits the small mass of pollen where it can fertilize the ovules. It was originally thought that the moth was attracted by nectar and was bent on taking sustenance; but she actually takes no food during her entire life. Therefore, the only end achieved by this action is the fertilization of the plant and the production of a seed pod on which her offspring will be able to feed. One wonders what either the plant or the insect did before it had the other.

As the young larvae eat only a few of the seeds many are left to carry on the life cycle of the yucca, so the strange co-operation of plant and insect goes on to the joy of all of us.



↙ One of the pods, still slightly green, was forced open and photographed (magnified) to show the internal construction. The large black seeds are shown ready to fall, and in the center the arrow points to the larva of the yucca moth, which alone pollinates the yucca and ensures its reproduction. The larva has been disturbed by the premature opening of the pod.

▸ ABOUT THE TIME the pods are hardening and ready to expel their seeds, the full-grown larva bores its way out, leaving the hole visible in this picture. It then drops to the earth, probably by means of a silken thread. There it bores into the earth several inches and spins a tough silken cocoon mixed with soil. This operation probably occurs at night. It will be ready to emerge as a full-grown moth in the spring, when the flowers of the yucca are blooming again



▾ AFTER THE FLOWERING STALK has cast off its share of seeds, it becomes dry and brittle, so that it can readily be broken off. The once erect hemisphere of bristles turns its spines backwards toward the earth, and the last chapter in the life cycle of the lovely yucca has been told

King Crab — mode

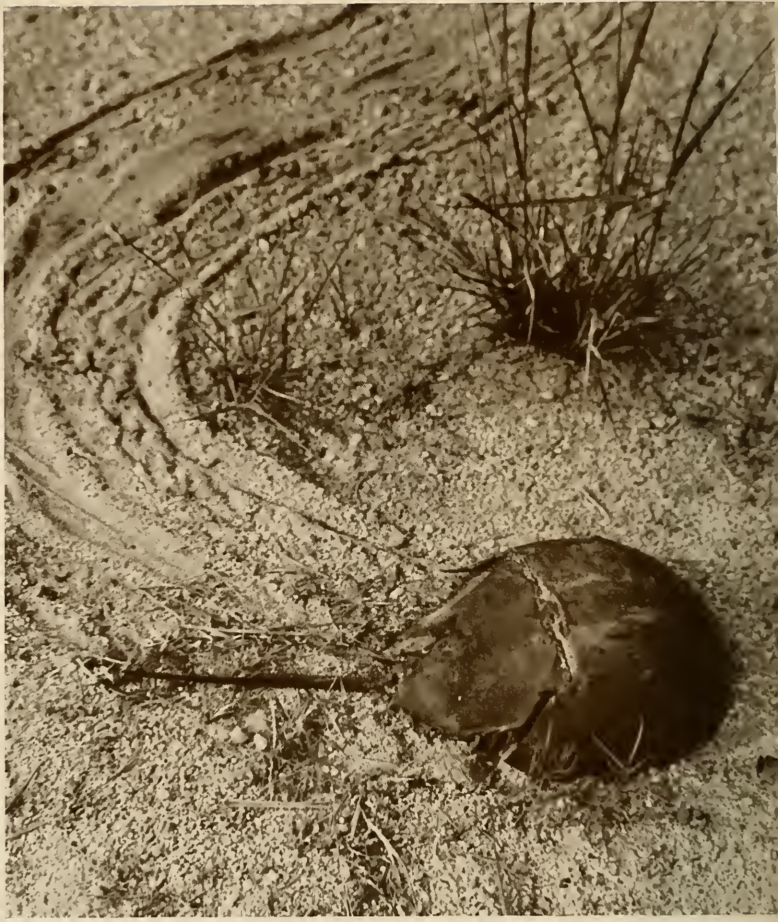
By Edwin Way Teale

On that late May day of fog, I was walking alone across a wide sea-meadow. The woods behind me, the level moor on all sides, the slate-blue line of the bay ahead—all these, minute by minute, had grown more indistinct. At first, like faint breathing on a mirror, mist from the sea had silvered the distant landscape.

Then, pearly gray streamers of thicker vapor drifted in, succeeded, in turn, by heavy, rolling fog that flooded in noiseless breakers across the moor. The horizon drew swiftly closer. The visible land contracted to a disk with a rapidly diminishing radius. Soon, I could see no farther than a score of feet in any direction. I seemed confined in a circular room—a room with indistinct and silvery walls and a floor of wiry grass and salty Salicornia.

It was a chamber that, like some nebulous snail shell, moved when I moved and halted when I came to a stop. It progressed with me as I felt my way down the path. This strange pilgrimage, this advance through a world half air and half water, was well-suited to the even stranger pilgrimage I had come to this lonely moor to witness.

Moving through the mist, cut off from the rest of the world and surrounded by vegetation that appeared low and primitive, I had the feeling of being carried back to an infinitely remote time. The present had receded, not suddenly, but as if I had slipped gradually backward through millions of years. It was at the edge of the sea, and on a shore saturated with the moisture of vapors, that land life, in forms now long outworn, first gained an initial foothold. On the solitary stretch of mist-enshrouded moor, I seemed infinitely closer to this dateless beginning of things.



▲ A King crab on the dry ocean beach. Although these so-called horseshoe crabs are underwater dwellers and breathe through gills, they are able to endure a day or more on land without water

Groping my way forward, I saw darker lumps of gray evolve into bushes. I followed their wavering ranks and came to the edge of the bay. Above the tide-line, sea weed, carried ashore by storms, clung in a windrow to the stiff moor grass. Bleached by the sun, it wound sinuously away into the fog like the sloughed skin of some gigantic serpent. Below, edging up the slope of the shore, the tide was nearing its flood. On the narrowing strip of mud and sand, between the farthest grass-clumps and the edge of the water, a lacework of tracks recorded the activity of the shore birds.

The world's first writing was formed of tracks, and the world's first mud tablets were formed at the edge of the ocean. The earliest characters set down in this track-written record of events were produced hundreds and millions of years ago by some long-vanished form of life.

The creatures I had come to this remote spot to see were contemporaries of some of the earliest experi-

rn creature of the past

While countless other forms of life have changed their ways, this curious, plodding creature has remained virtually the same throughout 300 million years of evolutionary history

mental creatures that first appeared in that disputed realm between the tides, just as they are contemporaries of all the varied life of the present. They were descendants of the trilobites and have survived virtually unchanged through ages and eras and epochs of geologic time. For 300 million years, they have formed an unbroken thread, linking the past and the present. While whole seacoasts have lifted above the water or sunk beneath it, these ancient creatures—the king crabs, or horseshoe crabs—have continued to endure.

In form and habits they have stood still, while hundreds of millions of years have had their way with countless other forms of evolving life. The king crab reached its heyday before birds or mammals appeared on earth. The same lithographic stones of Bavaria that yielded the remains of the earliest known bird, *Archaeopteryx*, also contained perfectly preserved bodies of *Limulus*, the king crab, alike in every respect to those we see today.

Every year, when spring is well advanced along our eastern shore, these living fossils come home from the sea. They make an annual pilgrimage, a mating migration, to deposit their eggs in the shallows. This journey has had its counterpart during all the years since Paleozoic times. On the edge of the fog-enshrouded bay, that late May afternoon, I witnessed once again, a re-enactment of this world's oldest love story.

As in the Biblical tale of Noah's ark, the animals each spring walk two by two. The mating impulse runs through the wild and stirs even these low-pulsed, armored creatures of the shallow ocean bottom, bringing them up to the verge of the tide-line. Even within the confines of my fog-formed horizons, I could see three of these dark, flat-bodied creatures, nearly a foot across and having roughly the outlines of a horseshoe, moving about in the shallow water. Their backs, wet and shining, pushed above the surface from time to time. They suggested black washbasins, inverted and moving under their own power.

Close to the upper limits of the tide, the females were working. They were pushing this way and that in the wet sand. They were scooping out depressions an inch or so in depth. In these shallow holes, the eggs—round and greenish-hued—would be deposited. A thousand or more pour into a single depression to be fertilized by the milt of the male.

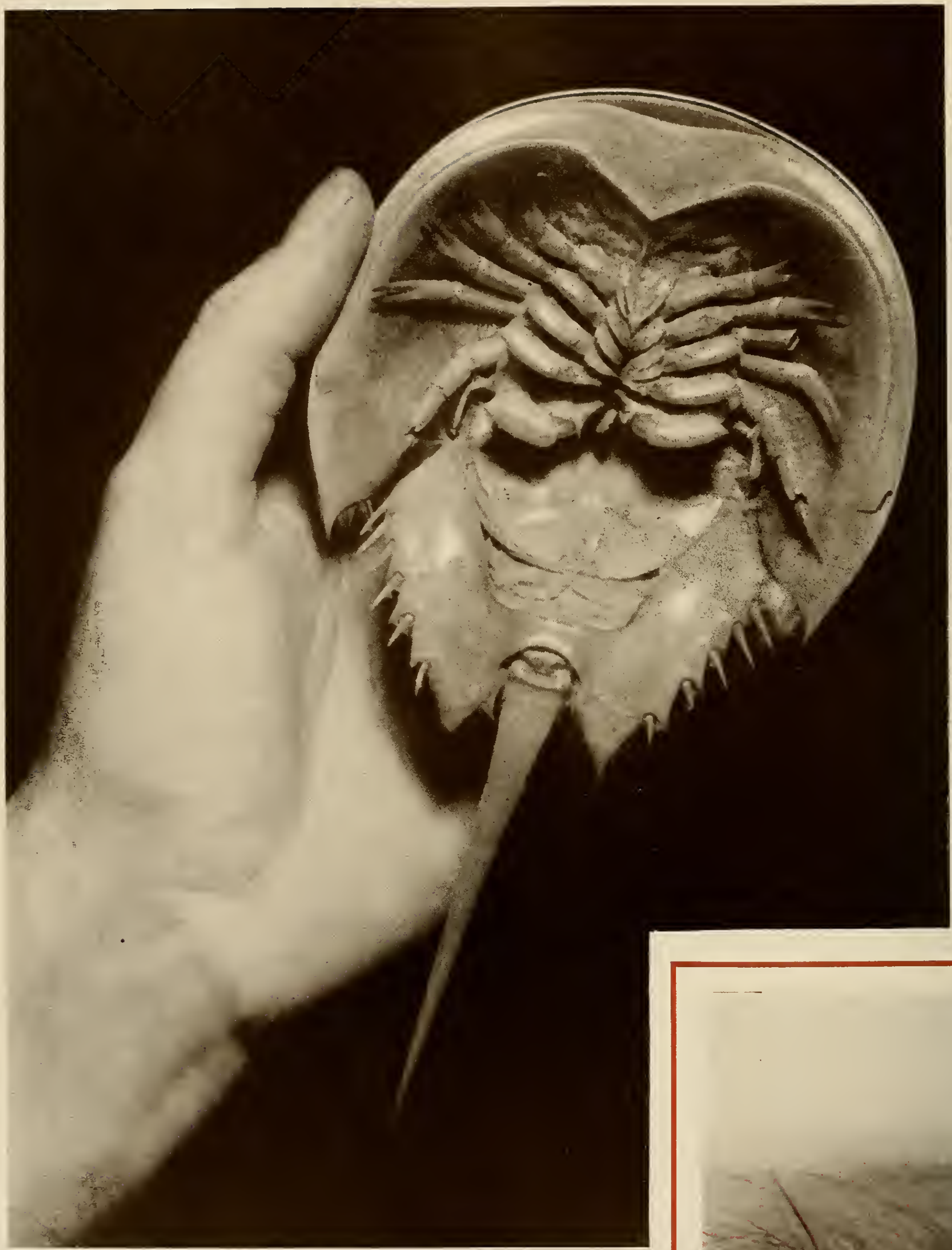
No mating like that which takes place among higher animals, occurs in the world of the king crabs. Sometimes, a male will appear, attached to the female—in fact, there are instances of a whole chain of males, like the tail of a ponderous kite, being pulled along by the larger female. But in such instances, the males are being borne along to the spot where their milt will be needed to fertilize the spawn.

After the male, or several males, have spread the fertilizing fluid in the water, the work of the king crabs is over. They move on to repeat the performance farther down the beach, leaving the waves and the receding waters to cover the eggs with a layer of sand. One female king crab will deposit as many as 10,000 eggs in the course of its spawning season. And all down the Atlantic coast, from the Maine headlands to the hot sand flats of Mexico, during May, June, and July each year, other females are depositing their contributions to the astronomical total. And that total, today, is but a small fraction of the total a century ago. Less than 90 years have passed since one English naturalist estimated that on certain sections of the coast there were sometimes as many as one million king crabs visible on a single mile of ocean beach.

Usually, it is during the hours of darkness that these sea-creatures come up the slope of the ocean bottom to the tide-line. But on a number of occasions I have observed them at work in broad daylight.

Each of the shapes I saw moving in the shallows before me had started life at least four years before on such a beach as this. The egg from which

▼ A KING CRAB progressing across a sandy beach leaves a ribbon of tracks such as is shown here. Because of its long, pointed tail, it is also known as a swordtail



▲ THE SKIN shed by a young King crab at molting time. The creature gives the impression of "creeping from its own mouth." The skin splits along the curved forward edge of the shell and the soft, molting individual pulls itself from the "outside skeleton," which it is discarding it had come had been warmed by the sun's rays at low tide and bathed by the sea water at high. It had lain there for a period of from three to ten weeks, according to how cool or how hot the weather was. As the days passed, the sphere, less than one-twelfth of an inch in diameter, grew transparent. The little passenger within became visible, curled up in the manner of a pill bug. When it crept forth, on some July or August day, it had no spine-tail projecting to the rear. This would come after molting began. At first, its appearance suggested the long-vanished trilobite. Hence, the name for the baby king crabs: "trilobite larvae."

The minute creatures that hatch in this way are the fortunate few. Of the thousands of eggs laid by the female, vast numbers are destroyed before they reach the hatching stage. Storms uncover the nests. Many of the tiny spheres roll about on the bottom of the shallows. Others are carried by the waves up on the dry beach. Fish get some; birds get some; even people, in some places, consider the eggs of the king crab a delicacy. The fate of the eggs is various, and only a small percentage produce the crabs of a new generation.

Sometimes, even as they are laid, they are devoured by their enemies. I remember reading a report in *Science*, in the early 1930's, of a great commotion noticed near the mouth of the Caloosahatchee River, on the Gulf Coast of Florida. Across the shallow waters of a sandy flat, king crabs were laying their eggs. Catfish, by the thousand, had been attracted to the feast. According to the correspondent, Louise Merrimon Perry, a noted shell collector of Sanibel, Florida, each female and male king crab were surrounded by a rosette of shouldering catfish, each fish almost standing on its head, with its tail, partly out of the water, lashing the surface into foam. Even as the eggs were laid, the catfish gobbled them up. In spite of the confusion around them, the king crabs continued their fruitless depositing of the eggs.

Although unable to survive the ravages of such foes, these green-tinted spheres can endure adverse weather conditions and surprising hardships. In one instance, king crab eggs were left forgotten in a jar in a laboratory for 50 weeks. When they were restored to natural conditions, they hatched and produced larvae. Packed in seaweed, king crab eggs have made the journey from America to England and have arrived in good condition. The vitality of the eggs, which are left deserted to the mercies of fate on the sandy beach, is an important factor in the continuance of the species.

On its emergence, the "trilobite larva" usually creeps down the slope of the shore, away from the dry sand. Scientists have tested king crabs at various stages of their development and have found that they possess an acute sense of gravity. Cover their eyes so they can see nothing and they will head directly down the beach for the ocean. If, however, you prepare an artificial incline that slopes away from the water, they will just as readily head downhill toward dry land. It is the slope and not the call of the sea that guides them on their journey.

As a rule, the young king crabs remain close to shore during their first summer. One striking exception to this rule was observed by Alexander Agassiz. He found young king crab larvae swimming at the surface of the sea fully three miles off Buzzard's Bay. But, normally, the larvae are encountered in tide-pools along the rocky northern coast and among the flooded grasses of shallow arms of the sea. Not far from the spot where, in the fog, I watched the adult crabs at work, I once found half a dozen pale-yellow discarded skins of immature king crabs within the area of a square yard. They were of several sizes and represented different molts. During the first summer of its life, the young king crab molts several times. On its first birthday, it is hardly more than an inch in length. Some individuals keep on growing for eight years or more. A king crab is sexually mature at four years. When it has attained its full size, it may be a foot across and more than two feet long, counting its slender lancelike tail.

This tail has given rise to one of the many common names by which the king crab is known: swordtail. Its general shape explains the familiar designations of horseshoe crab and horsefoot crab. And pioneers, who sometimes used its empty shell for a basin, called it the pan crab. Scientists the world around refer to our Atlantic coast species as *Limulus polyphemus*. And at the risk of adding to the confusion resulting from so many different names, it might be pointed out that the king crab is not a crab at all. It is an arachnoid, a relative of the spiders, mites, and scorpions.

In performing each of its many molts, the creature seems to "creep out of its own mouth." The shell of chitin—the same material that forms the outer skeleton of the grasshopper, the beetle, and the butterfly—splits along the curving front edge of the sheath. The upper and lower plates separate. Just as a dragonfly appears from its nymphal skin, soft and defenseless, so the crab emerges from its shell. The chitin of the new shell soon hardens, however. It may range in color from sage-green to pure black.

▼ **Along lonely seashores,** King crabs come in large number to deposit their eggs in the shallows

Observed in the water, a king crab almost always appears completely black.

As the tide reached its flood and slowly edged back down the slope before me, on that late spring day, there was movement and then long pauses among these creatures that had come in from the sea. One female finished her work and, in moving in a wide turn, pushed, in her near-sighted way, close to the upper verge of the waters. Reaching down, I gripped her long spine tail and lifted her dripping body out of the water. Tipping her on her back, I deposited her upside down on the beach. In this position, I had a chance to examine her closely. The inspection suggested that the creature was something turned out in mass production. It looked as though it had come from one of the stamping machines of a Detroit automobile factory. Its armor, surrounding its surprisingly small, vulnerable inner body, protects it completely from almost all of its enemies. It moves along like a tank on the ocean bottom. Only the devil rays and the swordfish appear to devour king crabs as part of their regular diet. Sometimes, a king crab gets one foot caught in a closing clam shell. Otherwise, it is so well protected from its foes that it is almost invulnerable.

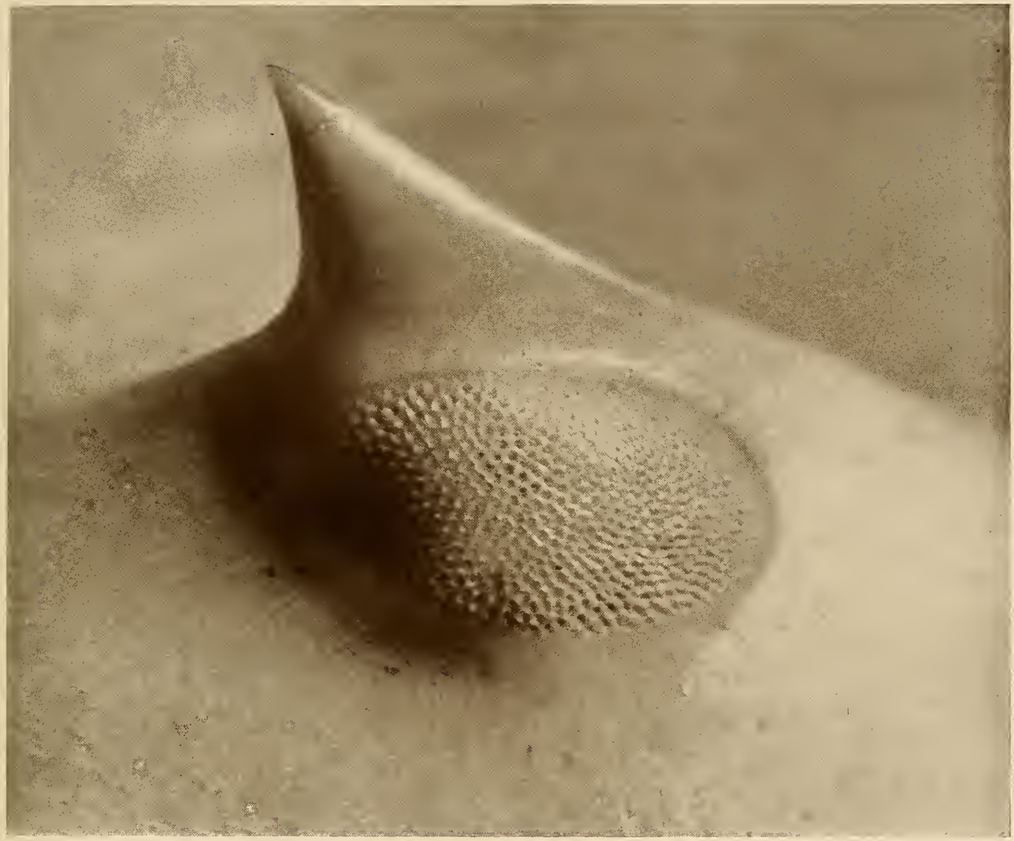
Even far-famed Yankee ingenuity has been unable to find much use for the king crab. Virtually the only commercial employment of these animals is in the making of fertilizer. I remember seeing great numbers stacked within wire enclosures on the coast of Cape May, New Jersey. This reeking pile was being made ready for grinding into fertilizer. Occasionally, the sea creatures have been fed to pigs and chickens to fatten them. Some New Jersey poultrymen believe the meat of the king crab will make hens lay. Others maintain that the diet gives the fowls a strong and unpleasant taste when they are cooked. Thus, the slight value of the king crab to man, as well as its armored form, has protected it from destruction.

With her numerous legs clawing the air impotently, the female I had placed on the sand tried to right herself. The spine tail dug into the beach. It twisted her body from side to side. This lever-action would eventually turn her over right-side-up after many attempts. Until this was accomplished, the normally hidden parts of the creature's body were visible. The vital parts consist only of essentials. A heart, a brain, a digestive system—this is virtually all the inner body contains. Breathing is accomplished by means of "book gills"—a series of from 150 to 200 plates that are hinged like the leaves of a book and are located beneath the rear section of the shell. Through each of the hollow leaves blood flows, carrying oxygen to the life stream of the king crab. Appropriately enough, considering the ancient lineage of this venerable creature, this vital stream is formed of blue blood.

The book gills have a double purpose. Like the dragonfly nymph, which obtains oxygen and at the same time propels itself forward by drawing water into the alimentary canal and then ejecting it forcibly, the king crab uses the plates of its gills to drive itself through the water. When it makes one of its infrequent jumps off the bottom and propels itself through the water, the moving paddlewheel of the leaves of the book gills provides the motive power. Such bursts of activity usually occur at night when the creatures are feeding on the floor of the shallow sea bottom.

Most of this feeding by the adults is carried on in water with a depth of between 12 and 36 feet. Few venture into deeper water. Small marine worms form the staple item on their bill of fare. Like rooting pigs, they burrow in the mud, pushing the curved forward edge of their shells

▼ A PREHISTORIC TRILOBITE, the ancient creature that appeared as early as 500 million years ago. The King crab is one of the closest links we have with these extinct inhabitants of the earth



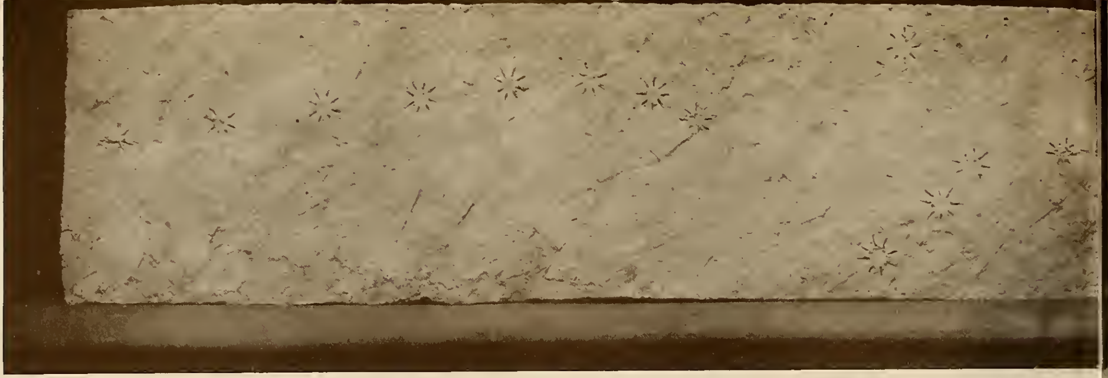
▲ The eye of a King crab, like the eye of an insect, is a compound organ made up of many small lenses. The spine above the eye points backward

into the soft ooze by means of their clawing feet. For long periods, their hunger satisfied, they will lie buried to the eyes in the ocean-bottom mud. It is probable that this pushing of their bodies through the dirt scours the shells as a knife is polished by repeatedly thrusting it into sand. At one time, scientists suggested that king crabs produce some unknown secretion which prevented barnacles and other sea creatures from adhering to them. That king crabs are not immune to the work of barnacles is revealed by a shell I once saw after it had been brought up from the sea bottom on the coast of Florida. Twenty or more barnacles were attached to its back. This particular creature may have been ill or less active than the normal king crab.

To the student of animal evolution, the notched rear portion of the king crab's shell is of much interest. It indicates that in the far distant past this part of the creature's body was formed of a number of segments, just as were the bodies of the extinct trilobites. Like all animals, individuals among the king crabs have peculiarities and variations of their own. One day, on a visit to the National Museum, in Washington, D. C., I was shown a curious king crab shell. It possessed a double tail which formed an elongated letter V. Another individual characteristic is the ability of king crabs to endure removal from water. Some can live for surprising periods and almost all of them can stand being stranded on dry land away from their normal source of oxygen for a day or more.

As soon as the female I had lifted from the water succeeded in prying herself on one edge and then over into an upright position, she started scrambling down the fog-enshrouded slope toward the receding tide. A moment later, the waters swallowed her up. Behind, among the bird-tracks, she had left a ribbon, a foot wide and filigreed with many-footed tracks. This marking on the wet sand was familiar to the earth long before the first wedge-print of a sea bird made its initial appearance. The disturbed female was going back to deeper water. The other workers continued unmoved in their labors.

But, they, too, would—in the course of time—return to the sea from which they had come. Groping my way back through the fog—along the edge of the inlet and down the familiar path—I left them behind me, enveloped in the mist. That hour on the lonely beach had been one of those memorable events—an hour lived in a world of fossils returned to life.



▲ **THE CREATURE** that made these dollar-size, eight-pointed impressions always left eight of them in a row. The additional "stars" on these slabs were parts of other series destroyed during excavation

From these curious little starlike impressions found in Montana, scientists reconstructed a strange story of undersea life more than 60 millions years ago

The Mystery of the 8 pointed STARS

By BARNUM BROWN*

Curator Emeritus of Fossil Reptiles, The American Museum of Natural History

In solving a mystery the modern detective usually has a *corpus delicti* and other evidence that is comparatively fresh. The fossil hunter, however, often has to work with far fewer clues, because the events that he is trying to reconstruct happened so long ago that the entire environment was different and the participants unlike any living on earth today. The interpretation of the evidence and the elucidation of all the circumstances then becomes fascinating. Such is the story of the star impressions.

The Valley of the Yellowstone River in Montana is bordered by high yellow sandstone cliffs from which the river took its name. Paralleling it to the north is the Musselshell River, and from a tributary of the latter stream Mr. A. E. Perry of Winnett, Montana, several years ago sent a block of stone to the American Museum on which an eight-pointed star impression was deeply incised. The star had sharp sides, and where the rays approached one another they terminated in a central, unmarked disc. There were small piles of sandy matrix at the end of each groove.

This track, the size of a silver dollar, puzzled every scientist who examined it. Many explanations were offered as to its origins, but none were satisfactory. If it were a "footprint," what sort of creature could have made it?

Footprints are sometimes classed only as circumstantial evidence, but they have shed light on a good many mysteries. So I was determined to visit the locality and make a careful study of the tracks in position.

Mr. Perry, who sent the first specimen, had moved from Winnett, and a local collector who was sent to the

A.M.N.H. photos

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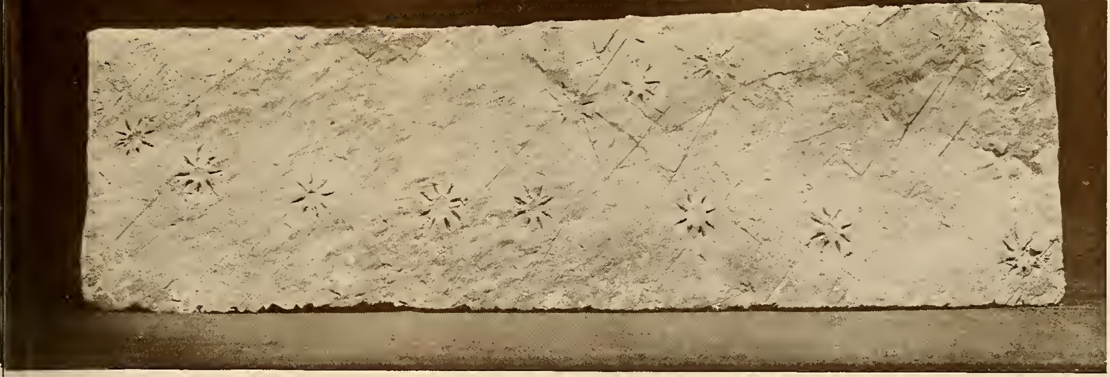
* DR. BARNUM BROWN is one of the most celebrated dinosaur hunters in the world. He is therefore generally on the lookout for larger creatures than the ones which left these curious star-shaped tracks. But anything that presents a riddle in the realm of prehistoric life is apt to capture his curiosity, and his explorations have taken him to many parts of North and South America, including the southernmost sections, where he was once shipwrecked, as well as to India, Abyssinia, and the Mediterranean region. He has been with the American Museum for 48 years. Much of his exploring has been by airplane, and he is planning to make another expedition as soon as helicopters are available.—ED.



locality failed to find the rock layers where the specimen had been found.

Later, in 1932, Mr. George F. Shea of Billings, Montana, reported star impressions on a farm eighteen miles south of Billings. That fall we drove to the spot. The highest rocks of this area are of Eagle (Cretaceous) Age and were laid down some 60 million years ago. Below the sandstone cap are older dark gray shales and thin layers of hard, flinty sandstone. Fifteen miles south of Billings you find these hard layers cut by tributary streams and exposed as ledged terraces, which break off in blocks of irregular size. Above, on the hillsides, the streams head in farmlands, coursing over beds of the hard siltstones.

In this locality we uncovered eight of the curious impressions in a line in a depression in a field. Snow and lack of time permitted us only to make a photograph of them, but this served to stimulate interest and increased our desire to learn what made the impressions.

Eight years later a single perfect specimen was sent to the Museum by Mr. Oscar T. Lewis from a locality fifteen miles south of Billings, and in 1941 Dr. W. G. Pierce of the United States Geological Survey photographed several impressions from a point northeast of Cody, Wyoming. Some of these showed feathery grooves running sideways into the deeper cuts. The story was now becoming intensely interesting.

All of the impressions appeared to come from rocks of Upper Cretaceous Age, specifically from what is known as the Mowry Formation, which means that they were some 60-odd million years old.

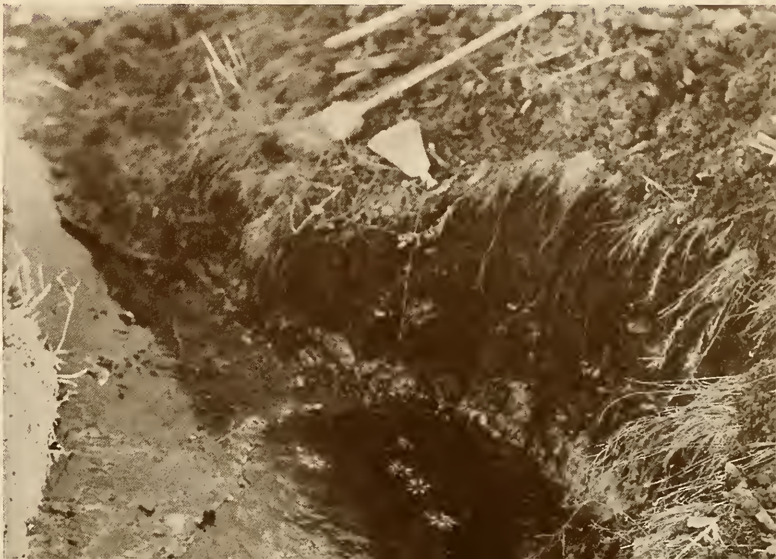
Opportunity to revisit the Billings locality came in December of 1942 while we were on a dinosaur hunting expedition. In company with Mr. George F. Shea and Al Stolz (now Private Stolz), the writer proceeded to the track exposures to excavate and study them in position.

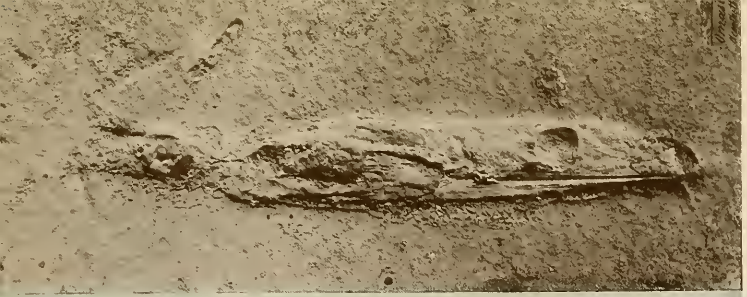
Snow, running water, and frost made work difficult, but we uncovered several series of impressions and collected two complete sets. In doing so, we discovered several pertinent facts. The impressions, when they were complete, always included eight tracks forming a relatively straight line with variations in spacing as shown in the photographs. And they were invariably covered by a layer of white kaolin or bentonitic clay from one to seven inches thick, beyond which on the same layer of rock there were no tracks.

Many fish bones, fish scales, and an ammonite shell were found embedded in hard rock—evidence that

▼ The two slabs of tracks were taken from this spot on the Ira Hartley farm in Montana. The rocks are more than 60 million years old. George F. Shea of Billings, Montana, who reported the tracks in 1932, is standing near the right-hand row of tracks. Seated opposite the left-hand one is Al Stoltz

▼ Below the freshly cut bank, the left-hand slab has been trimmed and is ready to receive a plaster cast. The white clay visible at the foot of the bank covered the tracks as a layer of volcanic dust, and was apparently necessary for their preservation. Where it disappears, so do the tracks





▲ **From Eichstädt, Bavaria,** comes this clue as to the nature of the animal that made the prints in Montana. It is a fossilized squid of the Jurassic period, *Plesioteuthis prisca.* Note the similar imprint of its tentacles

the rocks had been formed under a sea. But we found none of the creatures that could have made the star impressions.

We collected samples of the clay which, when analyzed, proved to be of volcanic origin. This clay, which must have drifted into the sea as dust, had apparently been necessary for the preservation of the tracks. Many tracks were probably made on the soft sea bottom, but if they were not filled rapidly by the overlying clay, they were presumably soon obliterated. We can assume, therefore, that the creatures were quite numerous.

When the blocks were prepared for study, it was found that some showed slight feathery scratches on the edges of the impressions, as in the example found near Cody, Wyoming. In most of the tracks there were small piles of sediment on the inner end of each deep cut. Some of the impressions measured in the field were larger than others, but in each series all impressions were of the same size and evidently were made at intervals by the same creature.

Now, in early marine rocks of the Jurassic Period in Western United States and Canada, cigar-shaped fossils known as *Belemnites* are found in countless numbers. Each fossil represents a part, called the guard, of the internal skeleton of a squidlike animal. None of the softer body parts have been found preserved in America. This hard part is closely associated with the ink sac that enables a squid to cloud the surrounding water and escape its enemies. In some places *Belemnites* cover hillsides and fill depressions thicker than raisins in a cake. About 350 species of *Belemnites* are known throughout the world, ranging from the Lower Jurassic to the uppermost Cretaceous, and they are important as index fossils.

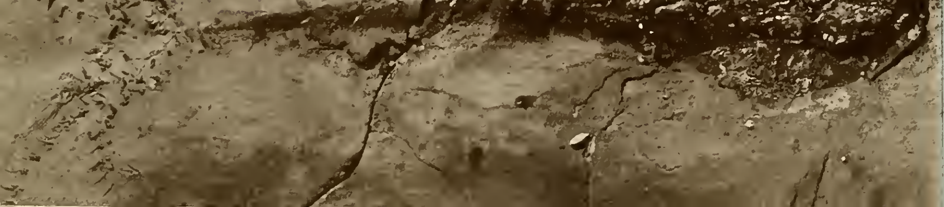
In some kinds of living squids, the hard part corresponding to the *Belemnite* is the familiar cuttlebone fed to canaries, while its tentacles or arms are provided with disclike suckers. The tentacles of ancient Jurassic squids were provided with lateral rows of horny hooks, as shown in a specimen preserved in the Peabody Museum of Yale University. These hooks would account for the lateral scratches bordering the deep cuts made by each tentacle, assuming that the Late Cretaceous squids were similarly modified.

Further to substantiate the case, there is in the American Museum collection a fossil squid from the Jurassic lithographic stone at Eichstadt, Bavaria, in which there is a clear imprint of eight tentacles lying in exactly the same relative position as are the radii of the fossil impressions in question. Moreover, the tentacles are almost the same size as would be required of those that made the fossil markings. Thus there is fairly conclusive evidence that squids were the makers of the impressions.

But we must still account for the regularity and number of imprints in each series, for living squids usually swim in a horizontal position. This leads us to the egg-laying habits of living squids.

In observations on the female squid *Loligo pealii,* G. A. Drew notes, "Toward the end of the period during which the string of eggs is held, the animal shows an increasing tendency to turn the body into a nearly perpendicular position to bring and keep the tips of the arms in contact with the bottom. . . . With the arms held rigid and the tail fin moving rapidly, she goes bounding along on the tips of her arms, dorsal side foremost with a movement somewhat similar to the bounces that may be obtained by pushing a lead pencil, held by one extremity and slightly inclined from the perpendicular, over a table. This action is generally repeated several times."

Each female lays many strings of eggs during the season (June to September), and Drew calculated it took two minutes for each placement of eggs. These observations were made on specimens kept in aquariums at the Marine Biological Laboratory at Woods Hole, Massachusetts; therefore the recorded movements were not influenced by tides. It is reasonable to suppose the habits of ancient squids were similar to those now living, and the position of the



◀ **Hooklike claws** are seen on the tentacles of this squid from Lower Jurassic times, reproduced at about ¾ actual size. They offer an explanation of the feathery scratches found on the edges of some of the eight-pointed stars from Wyoming. (*Geoteuthis bollensis,* from Lyme Regis, England)

Courtesy of the Peabody Museum of Yale University

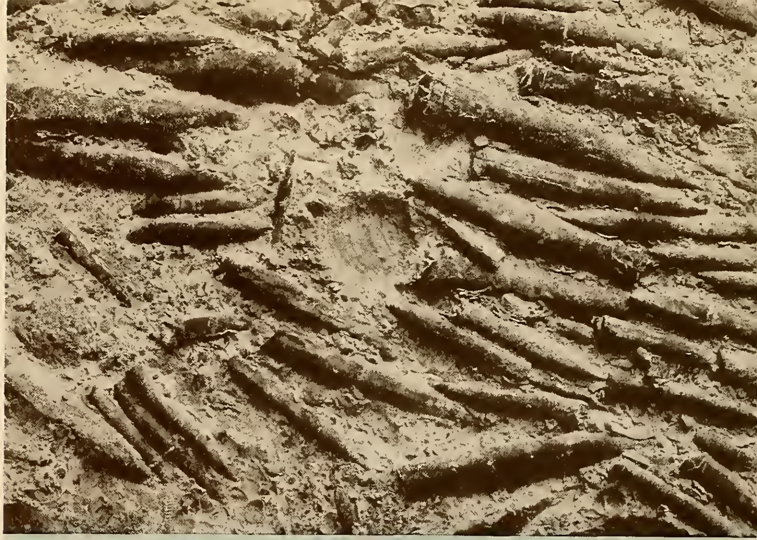
animal just described would seem to be identical with the posture the ancient squid would have assumed at the time the impressions were made.

Why were there always eight impressions in each row? Ten complete series were uncovered during our work, and there were never more and never fewer than eight if the area of the rock was large enough to show the complete series. In each case, the individual impressions were distributed in the manner shown in the photographs. The series were lying in different directions, sometimes parallel, but we could not uncover enough area to establish any general relationship to a possible shore line. Nevertheless, I am of the opinion that wave action was in part responsible for the way in which the tracks were distributed.

Close examination shows that where the rays of the stars were pressed into the mud the impression is not always symmetrical. Sometimes one side of the groove is more acutely incised than the other, and in some cases it even overhangs the bottom of the groove itself, as it would if considerable pressure had been exerted on one side by motion of the water. Wave action has been detected as deep as 600 feet below the surface, so there is no reason to suppose the egg-laying was restricted to shallow shores. Since these seas were inland bodies of water, tides would probably not have been perceptible.

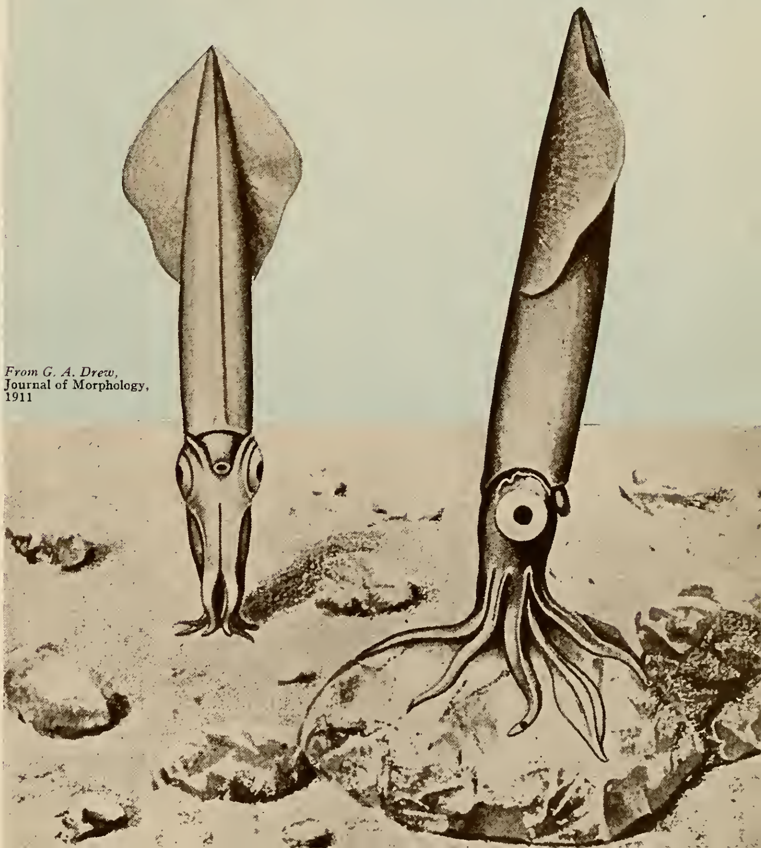
To visualize these tracks in the making we picture myriads of Mrs. Squids bouncing along the bottom of a shallow turbulent inland sea, interested in depositing eggs. Mrs. Squid reaches the bottom and holds to the spot selected, busy with her own affairs. As water pressure tends to shift her position, her eight tentacles cling to the soft bottom, holding on and cutting in as her body is being lifted clear. After about two minutes she again touches bottom, and the process is repeated eight times in all.

The position of the impressions in series of eight could be related to the disturbance of the surrounding water induced by the cycles of movement between crest and valley of waves above. But the most satisfactory explanation of the number eight is that Mrs. Squid's supply of eggs, for the time being, was exhausted at the end of the eighth stance.



▲ ALTHOUGH THE REMAINS of squidlike animals have not been found in direct association with the tracks in Montana, these belemnites have been preserved in countless numbers a few hundred miles away in the Black Hills. Each belemnite represents a part of the internal skeleton of a squidlike animal

▼ LIVING SQUIDS (*Loligo pealii*) have been observed laying their eggs in this position. They assume a nearly perpendicular position and cling to the bottom with their tentacles, depositing their eggs in intervals of about two minutes. Presumably the Cretaceous squids of Montana had laid all their eggs at the end of eight stances



From G. A. Drew,
Journal of Morphology,
1911

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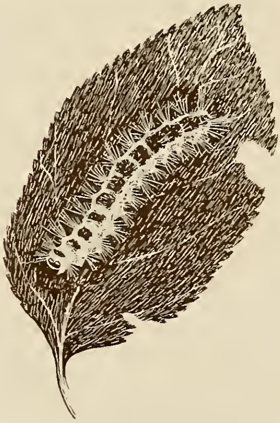
Insects in the House

THE FALL WEBWORM

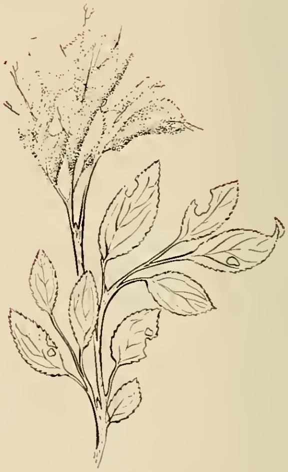
By C. H. CURRAN

Associate Curator, Department of Insects and Spiders, American Museum of Natural History

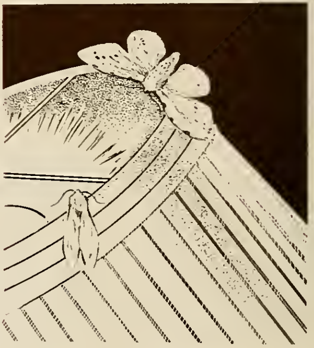
IT is not often that an insect enemy of trees or cultivated crops is also classified as a household nuisance, but there are times when such insects do invade houses in large numbers and become extremely annoying. At this season there is one that causes many persons to write to their local scientific authorities for help in exterminating it from their homes. This is the Fall Webworm (*Hyphantria cunea*), which attacks forest and shade trees. The caterpillars are the chief cause of worry in the home. The moths also enter houses in large numbers, being attracted to light.



There are two generations of Webworms each year, one in June and July, which is usually small, and one in August and September which may be very large. When the caterpillars mature they wander about in search of a suitable place in which to build a cocoon, and unless a building is tightly screened, they may crawl in and distribute themselves over the walls and ceilings. Also, their food supply may run out when they become so numerous as to completely defoliate a tree, and in that case the caterpillars go in search of other food. When this happens, the partly grown caterpillars become a particularly serious problem.



Control is rather simple, however, since the creatures can be destroyed by spraying the trees with an arsenical poison. Since the caterpillars are gregarious and live in unsightly "tents" on the branches, they may be destroyed by cutting off the parts on which they occur and burning them. This should be done while they are still young. If it is done during the development of the first brood, the size of the second brood can be greatly reduced.



TREES—WE LIVE WITH THEM

Photographic Tips

By THANE L. BIERWERT

Acting Chief, Division of Photography,
The American Museum of Natural History

WHEREVER a man lives, a tree grows. At the oasis in the desert, near the homestead on the prairie, along the village lane, and on the sidewalks of New York, wherever we find a habitation, except in the far north, trees are part of the landscape.

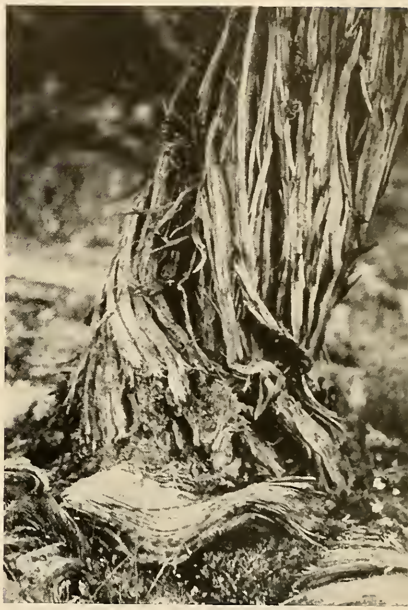
We shall develop a better appreciation of the part that trees play in making pictures more interesting if we know our trees and their characteristics. To develop that appreciation we might give ourselves a useful, year-round problem. Make a series of pictures suitable for lecture purposes or for the album that will show all aspects of neighborhood trees, both from aesthetic and educational viewpoints.

A foundation of tree knowledge is necessary before we can set out with camera and equipment. Arm yourself with a book with which to identify the various kinds common to the locality.

Select trees that are typical of the species. An elm covered with a "beard" of suckers is not a healthy tree. One found growing in a woods will not have developed the usual wide-spreading crown of foliage; it will be too narrow and "leggy." Buds, leaves, flowers, and fruit can be photographed on young trees. But it is the mature tree that has a truly representative silhouette and bark structure.

The trunk and bark are easier to photograph in autumn, after the leaves have fallen, when sunlight can strike the base of the tree. The beech and the gray birch will require glancing illumination in order to give contrast to their smooth bark. The rough texture of hickory, or maple will photograph best on a hazy, slightly cloudy day, when diffused light will fill in the otherwise black shadows. Trees that have unusually interesting bark, like the unkempt shagbark hickory or the mottled sycamore, will provide particularly striking close-ups to enliven your series. Since the bark of trees varies widely in texture, we should have some method of showing relative size. By photographing comparable views from the same distance, we can make slides or prints that will show in true proportion the differences in bark structure. Among these sets, the pictorialist will discover numerous pattern pictures for decorative purposes.

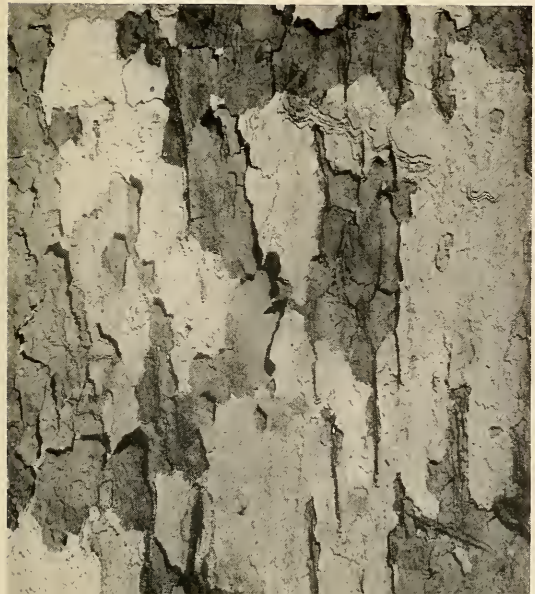
Good silhouettes of trees, whether in foliage or with naked boughs, should be made on clear days to give sparkle to the print or slide. The selected tree will be sharply outlined if it stands clear of its surroundings and against a contrasting background, which can be out of focus if far enough away. We may find that photographic conditions are ideal for a particular tree only during a certain time in the day. The subject will be lighted best when the sun is about 45° to either side of the camera, giving a pleasing roundness to the tree. Before exposing a negative or transparency, make this visual test to determine whether the tree will stand out in the photograph. Close one eye and stare at the center of the picture, slowly closing and opening your other eye, repeatedly. In a few seconds, you will see only blended tones that will have some of the quality of the finished picture. If the subject appears satisfactory, make the exposure.



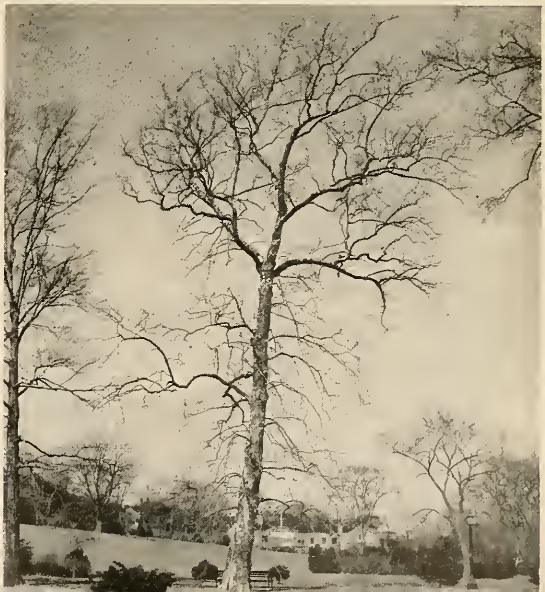
▲ THE GNARLED TRUNK of the Rocky Mountain cedar is best photographed in diffused light. Its fibrous bark was used for rope by the Indians

Photographs by the author

▼ SHARP SUNLIGHT helps to bring out the shallow fissures that give the variegated sycamore its scaly appearance



▼ SYCAMORES average 60 to 120 feet in height and are easy to recognize even after their leaves have fallen



Spring is the season to record the foliage. Then the leaves have not yet become insect-eaten; they are a pale, bright green and will photograph more as we see them. By mid-summer, many of the growths, especially on the evergreens, have become so dark in color that it is nearly impossible to capture detail in the negative.

Usually the branches are so high that we will need to pull the leaves down to tripod level to see their upper surfaces. Fish out of the gadget bag a piece of string and a tent peg. Drive the peg into the ground and tie the branch to it. This is much better than having someone hold the branch in position while we compose and focus, for if our assistant has an itch or if a bee buzzes by, we may lose branch, focus, and temper. The picture should show the form and structure of the leaves, and how they are joined to the branch. These are important for distinguishing similar species in a family. It may be necessary to thin out a few other branch ends in order to allow light to fall fully on the selected leaves and to get rid of distracting elements. A large shadow from a densely foliaged branch becomes an excellent background because it will not be broken up with small patches of sunlight. In the picture, a patch of sunlight appears as a brilliant out-of-focus area that is exceedingly distracting. Well-composed photographs of leaves are difficult to make. Success depends principally upon the selection of as small an area of the branch as will show the characteristics of the tree.

The film to which you have become accustomed is the one to use. With orthochromatic you will sometimes want a green, yellow, or polarizing filter. If you use panchromatic, which is better for most subjects, a red filter as well will be useful. The choice and use of a filter will depend upon the kind of day and the subject. A yellow (or red) filter will darken a blue sky. We can also separate a tree from a clear blue sky by using a pola-screen, with the handle pointed directly at the sun. Leaf surfaces that are veiled over with sky reflections can have the color and texture brought out by using the polaroid filter. The proper angle of polarization can be determined by viewing the subject through the filter and rotating it until the reflections are subdued, but not extinguished. Some highlights should be retained to give a natural glistening. A green filter will lighten the tone of the leaves. Thus when the tree blends into a dark background, a green filter will sometimes lighten the subject and bring it into more prominence. Generally, we find that the darker the background, the lighter the filter required to brighten the tree.

Close-ups are rendered in good detail without the addition of colored filters. And if the tones of the tree and leaves are well separated from the sky and other trees, we are safe in not using a filter.

Some of us will wish to bring home some leaves, flowers, buds, winged seeds, acorns, or chestnuts for indoor photography. For this sort of work, the major problem is to create naturalness in the set-up.

▲ So attractive an ornamental tree as the blue spruce deserves to have its cool, silvery-blue needles photographed early in the season

During the first few days of photographing trees, you will probably wish that you had a couple of lumberjack friends to clear away underbrush and to remove intervening boughs, or at least that you had the foresight to bring along your own ax. To record those "perfect specimens," no program of deforestation is really necessary. Move around a bit; another angle may provide just the view you want. When in doubt, make the exposure. Next year you may find a better tree.

The person who intends to make a complete series of educational pictures of the 30 most characteristic trees of his locality, should include photographs of each tree in silhouette, both in foliage and as a skeleton, and close-up views of the bole, bark, buds, flowers, leaves, and fruit. If the series has been made with any degree of uniformity, it may be worth while to inform some of the book publishers, because they are clamoring for good illustrations. There may be a pot of gold waiting for someone who is willing to make a rainbow of God's trees.

We have such a tendency to accept trees as a part of our environment that we seldom think of interpreting them for others. After we have come to know them individually and as species, we can show our friends how better to enjoy them as the strongest part of our landscape.

▼ Outlined against a somber sky, this oddly shaped Rocky Mountain cedar is a fascinating subject for any cameraman specializing in trees

ARIZONA'S ANCIENT IRRIGATION BUILDERS

Continued from page 310

Line has aroused interesting conjecture regarding the Desert Hohokam. More than a score of hill forts are known through the length and breadth of Papagueria. The summits of isolated volcanic hills, preferably protected by cliffs, were the favorite strongholds. Defensive walls of rough-laid stones, sometimes as many as seven in a series, barred ascent up the more accessible slopes, and on the crests of the hills within the fortified area are found clearings and terraces for homes. Usually near by in favorable terrain will be found a village site that was occupied except when danger threatened.

What was this danger? We are not sure, but there are some clues. The potsherds found in the refuse of these defensive sites are, with few exceptions, of the same order. This means that at a given period the threat of a hostile group was uniformly felt by all of the Desert People. This pottery occurs also as trade ware in the River Hohokam ruins when the red-on-buff of the Classic Period was produced, and both can be linked with Pueblo pottery of the fourteenth century as dated by the tree-ring method. Thus, the fortified hills can be assigned to the fourteenth century.

The next question is, what people were stirring about at this time to alert the Desert Hohokam? Here again, there is a plausible answer. Beginning about 1300, the Pueblo or Salado people of east-central Arizona extended their frontiers far to the south and west. Casa Grande National Monument and a host of other ruins are proof of the presence of these people among the River People. But so far, the domain of the Desert Hohokam has revealed almost no trace of these aliens. The time of the Salado thrust and the age of the hill forts roughly agree. It would be difficult to explain this without a cause-and-effect relationship. So, until proof to the contrary is forthcoming, we can cling to the idea that the Saladoans heeded the "No Trespassing" signs of the Desert Hohokam and remained for a time among the more friendly River People.

At about 1400, the archeological record of the Hohokam comes to an end. It has revealed the story of a people who rose from a simple agricultural state, up through illustrious achievements in husbandry, in the arts, and inferentially in the political and social phases of life, only to descend to a state of almost complete cultural eclipse. I say "almost" because I believe that further records of the Hohokam will eventually relate them to living people who still occupy the territory. The present gap in our knowledge may well stem from the archeologists' preoccupation with the larger and more productive ruins. Further research may also shed light on the origin of these agriculturists and reveal whether their roots penetrated to the simple hunters and food gatherers known to have been in southern Arizona before the Christian Era. At present, this seems more likely than the supposition that they came as immigrants, bringing with them those elements of culture that a thousand or so years later emerged as the rich precipitate here described.

The archeologist is also continually seeking to establish with greater clarity the process by which scattered farming communities came together to form populous urban centers, located among the canal networks and hemmed in by the fields from which the food staples were drawn. The rich assortment of textiles, carved stone, pottery, shells, stone, and perishable goods were the logical consequences of the agricultural accomplishment, coupled with some outside stimulation from tribes in Mexico. But after this great surge of cultural energy and only a few centuries after the Hohokam had reached their peak, symptoms of degeneration began to appear in their culture. The dissolution seems to have been rapid. Where a score of towns can be listed as thriving during the fourteenth century, not one can be certainly identified as having survived into the fifteenth and sixteenth centuries. Drought? Pestilence? Oppression? Internal strife? Exhaustion of the soil, or failure of the canal system? No one yet has a satisfactory answer. It is paradoxical, perhaps, that the earlier history of the Hohokam is better known to us than the latest phases of the culture, which were much nearer in point of time to the twentieth century.

The foregoing is not said with the intention of creating a mystery out of the problem of what happened to the Hohokam. There are a few persons, I among them, who concede the possibility that the modern Pima and Papago Indians of Arizona are the survivors of the Hohokam. This conclusion is based partly on logic and partly on the fact that there is a continuum of the mode of life and of many cultural elements from the pre-Spanish to the modern inhabitants. Before such a view can be flatly accepted, the present gap in our knowledge from 1400 to 1700 must be bridged. I have no doubt that future work in this direction will be richly rewarded.

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Continued from page 297

HUNTING, FISHING AND CAMPING

- - - - - - - - - - by L. A. Anderson

The Macmillan Company, New York,
$1.95, 214 pages, 20 plates

MODERN writers on outdoor sports usually assume that the reader has at least a basic training in hunting and fishing. Mr. Anderson takes nothing for granted. While not boring the reader with numerous details that can best be learned by experience, he gives the fundamental requirements necessary for a successful sportsman. These facts are presented in such a way that they are not only interesting reading but automatically fix themselves in the reader's memory. Mr. Anderson, who lives right in the Northwoods and spends every bird hunting and deer hunting season at his camp in northern Wisconsin, has gleaned his knowledge firsthand from practical experience.

In the first part of the book the reader will find practical information on how to shoot moving game and birds on the wing. This section includes a special chapter on deer hunting and discussions on the use of the rifle. There are also special chapters on grouse and duck hunting, and the kind of clothing to wear on a hunting trip.

The second section concerns fishing and begins with the relative merits of live bait and artificial bait. In subsequent chapters Mr. Anderson discusses fishing tackle, casting, and some useful tips on fishing. There is a special chapter on trout fishing and one on how to catch other game fish.

The third and last section of the book covers camping and preparation for the field trip. Here, the essential equipment for an enjoyable trip in the great out-of-doors is given, the kind of food to take with you and how to cook it. Every fisherman and hunter will agree that insufficient attention paid to these details may utterly spoil a vacation. Finally, after a brief chapter on the art of canoeing, Mr. Anderson gives timely advice on fellowship of the trail. He says: "Camping leads to good fellowship. It brings out the best in man, and the worst. Conditions are hardly ever perfect, but the man who makes the best of things is the one who will always come back for more. . . . Rain or storm does not deter this man. He can see the humor in a rainstorm, wind, snow, or hail. He takes them all in his stride."

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CAREERS IN SCIENCE

- - - - - - - - - - - - by Philip Pollack

E. P. Dutton & Co., Inc., $2.75
222 pages, 56 illustrations

CAREERS in Science is written primarily to serve as a guide for young people planning their life's work. The book sets forth the advantages and disadvantages connected with careers in more than 70 specific occupations and should be very helpful to individuals faced with making such an important decision. Moreover, *Careers in Science* is extremely interesting reading for any one, becaues it gives the highlights of science in a very entertaining and instructive fashion.

The field covered by the book includes chemistry, physics, biology, and geology. In addition there are chapters on "New Worlds and Careers" created by science, "A Woman's Place Is in the Laboratory," and "Futurama." A supplement contains two important articles on "The Outlook for the Physicist and Prospective Physicist in Industry," and "How Can We Develop Inventors?" There is a good bibliography at the end of the volume.

This is a tremendous field to be covered in a single volume, but the treatment is successful to the extent that it outlines the possibilities in each category, and the reader can decide which one of the fascinating avenues he may wish to travel. But selecting a career is not like picking the best item out of a catalogue. The individual must weigh carefully such factors as aptitude, capacity for learning the field in question, and ultimate personal satisfaction with the work. Such matters as salary and prestige should really be secondary, although the author, in each case, gives information on these points as well. But the really important questions the candidate for a career in science must ask himself are these: "Do I like it deeply enough? Do I have what it takes?"

The book is generously sprinkled with incidents, famous names, and outstanding achievements in science. Not only are these examples of how other people reacted full of human interest, but to a certain extent they bring the reader abreast of the times.

H. E. ANTHONY.

BEHOLD OUR GREEN MANSIONS

- - - - - - by Richard H. D. Boerker

The University of North Carolina Press,
$4.00, 313 pages, 167 illustrations

THE author of this book on forestry served with the U. S. Forest Service from 1910 to 1917, and for a time he was forester for the New York City Parks—in fact his primary life-time interest has been in this subject. He is the author of an excellent book on our National Forests and two on forest ecology.

The present volume is a comprehensive one covering every phase of the subject from wood as a critical war material to recreational forestry—always from the standpoint of human welfare. There are eighteen appealing chapters, including a modern definition of conservation; the relation of forests to wildlife, water supply, holding the soil, and flood control; lumber and its by-products; the forest as a live-stock range; forestry and agriculture; insect enemies; tree diseases; and fire, the destroyer.

A phase of forestry that interests the city dweller as well as the rural population is that of recreation, and during the past quarter of a century travel for recreation in this country has increased amazingly. In response to this growth, there are now more than 3800 picnic and campground areas, over 70,000 miles of streams suitable for fishing, and over 150,000 miles of riding and hiking trails in our National Forests.

There is a wealth of dependable information in this book, arranged logically and presented in an interesting and convincing manner. The reader will be surprised and pleased to find more than 150 very fine photographic illustrations, the majority of them full-page. In future printings of the book, it is hoped that there will be a list of these illustrations following the table of contents, or that they will be included in the index. The selection of the photographs is to be fur-

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ther commended in that they cover every section of the United States. It would be good for our people if this book should be required supplementary reading in all our schools.

Clyde Fisher.

Native peoples of the Pacific World

--------- by Felix M. Keesing

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The high standard of professional competence initiated by *The Pacific World* is maintained in this new addition to the Handbooks of the Pacific World Series. Professor Felix M. Keesing, Professor of Anthropology at Stanford University and author of this book, has been a close student of native life throughout the Pacific and has distinguished himself by a number of monographs dealing with specific areas and problems within its limits. He has brought together in one volume a necessarily brief description of the peoples of the Pacific and the distinguishing features of their native cultures in a manner admirably suited to provide a background to understanding the diversity of populations that inhabit this region. Although designed to acquaint our armed forces serving in the Pacific with the nature and character of the people they are likely to encounter, it is equally well suited to introduce the civilian reader to the people that form the background against which the fighting has been taking place. For, once the problems of the war are over, these people will remain, and a proper understanding of who and what they are and the difficulties that beset them will help enormously in restoring them to a well integrated life.

The charm and variety of the peoples of the Pacific and their way of life emerges in great strength from Professor Keesing's book. And one cannot help being fascinated by these interesting people for their own sake. I know no other book for general reading that covers this entire region. For that reason alone it serves a most useful purpose, but fortunately the competence of the author makes it also a reliable guide.

Harry L. Shapiro.

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------- by M. Wells Jakeman

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This is the first part of a proposed three-volume work intended as a general reconstruction of Maya history. It is an attempt to re-evaluate and synthesize our knowledge of the Maya and to integrate the results of such separate lines of research as archaeology, physical anthropology, and the studies of the hieroglyphics and documentary sources. The author is interested primarily in the historical accounts of the sixteenth century and believes that there is information in them that can be considered to apply to the whole range of Maya history as discovered by the archaeologist. These historical accounts are thought to be more accurate than has usually been supposed, and much of the book is concerned with their critical examination.

Dr. Jakeman's book is not a popular account of Maya history to be read as an introduction to the subject, although it does contain sections of general information belonging properly in such a book. With these, however, are certain chapters of a highly technical nature which could not be of interest to the general reader.

This is primarily a work for the specialist in Maya studies and, as such, we cannot adequately judge its merit before

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it is published in entirety. From what we do have, however, it is our opinion that Dr. Jakeman has in some ways approached the general field of Maya studies with a little less caution and care than would appear desirable.

G. F. EKHOLM.

OUR HERITAGE OF WILD NATURE

------------ by A. G. Tansley

Cambridge University Press, $2.50
74 pages, 26 photographs

THOUGH this is an excellent book, it is not one that will fill the wants of most American readers. It is written for residents of the British Islands having a real appreciation of nature in its aesthetic or scientific aspects or both. It is a strong plea for efforts to preserve the natural and beautiful features of the British landscape and its native birds, animals, and plants, with which the necessities of so many years of war have played such havoc, especially through the destruction of the forests and breaking up and exploitation of the large estates that used to serve as effective nature reservations.

The book gives interesting facts and pictures of areas that still retain more or less of their natural character. It is, however, written with a full appreciation of the difficulties that increasing economic pressure and indifference on the part of a large section of the public place in the way of preserving such areas.

Its author does not appear to be too hopeful of much being accomplished along that line, but tells what is being done by government and private agencies and organizations, and points out other things that may and should be attempted.

Our American conservation problems are, of course, not just the same, and fortunately have not reached the desperate stage that they have on the British Islands. Yet nature destruction is now going on far more rapidly here than in Great Britain, and the sooner we are willing to look ahead and face the facts the way this book does, the better it will be. Too many of us who think ourselves to be conservationists ignore the fact that "conservation" all by itself is merely an abstraction with no real existence unless applied to saving particular things.

WILLARD G. VAN NAME.

WEEDS OF LAWN AND GARDEN

---------- by John M. Fogg, Jr.

University of Pennsylvania, Press, $2.50
215 pages

THE Professor of Botany in the University of Pennsylvania has prepared an authentic handbook on weeds for eastern temperate North America, written for those who have lawns, gardens, or even flower-beds—not a textbook for students of botany, but a popular treatment for the layman. In the introduction, the author discusses: What Is a Weed? Why Some Plants are Weeds, The Dispersal of Weeds, The Geographic Origin of Weeds, The Extermination of Weeds, Chemical Controls, and Weeds as Soil Indicators.

The main part of the book is made up of descriptions of weeds accompanied by excellent line-drawings which are a great aid in identification. Of the 242 weeds treated in the book, it is interesting to note that more than half are of European or Eurasian origin; about one-third are native to North America; approximately 8 per cent come from eastern Asia or India; a little more than 5 per cent are indigenous to the tropical or subtropical portions of America; and less than 1 per cent are derived from Africa. The hook has a glossary, a well-selected bibliography, and an index.

CLYDE FISHER.

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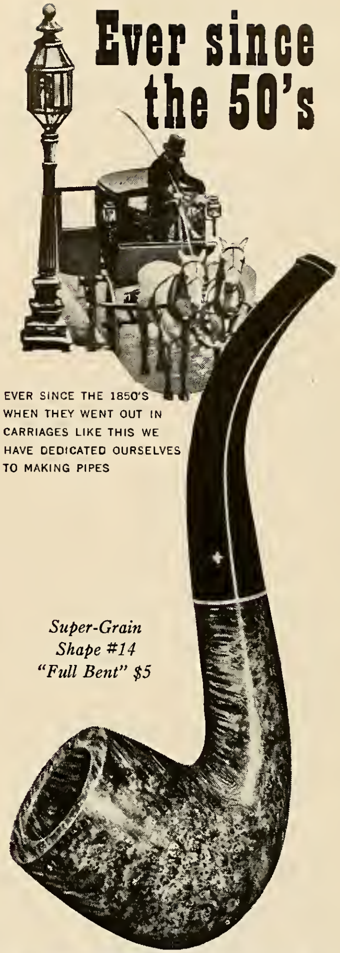

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LETTERS

Continued from page 293

full D. H. Lawrence beard covering almost the entire face except for the eyes and nose is never seen among full-blooded Negroes or Mongoloid people. At least the few long wispy hairs carefully preserved on the faces of some elderly Chinese fall far short of even the minimum requirements of a youthful white aspirant to such an adornment.

As far as I know, there is no direct environmental explanation of this diversity in racial hairiness. All that we can say is that genetic differences exist among the races of mankind in this character, some being endowed with a tendency to greater hairiness than others. That the differences are of immediate genetic origin seems indisputable when we observe that even within the white race or within any sub-division of it, individuals show a marked variation in their hairiness. Thus many white men show a sparseness of beard and others a much heavier growth. Often certain families tend to exhibit pronounced differences in this respect. Moreover, the areas of the face on which hair will grow often form distinctly different patterns that are probably hereditary in origin.

Harry L. Shapiro,
Curator of Anthropology,
American Museum of Natural History
New York, N. Y.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

Sirs:

In your June, 1945, issue of Natural History Magazine there is a series of photographs whose title, "A Gallery of Insect Portraits," is not in accordance with the animals pictured. . . . The scorpion, tarantula, and jumping spider are not insects, but are in the class Arachnida. . . .

Alice Hassard.
Forest Hills, N. Y.

* * *

Sirs:

In the March, 1945, issue under the title "Nature Through the Camera's Eye," it says in smaller type, "Three Insects and Their Prey." Two of the three "insects" referred to are spiders, not insects. . . . Again in June, 1945, we find "A Gallery of Insect Portraits," among which are a scorpion, a tarantula, and a jumping spider. . . .

Paul Griswold Howes,
Curator, The Bruce Museum.
Greenwich, Conn.

In the strict scientific sense, these objections are valid. Even in a title, where it is difficult to mention everything in a few words, it would be more precise to use the term "arthropods" instead of "insects," though it might frighten some readers more than the creatures themselves. However, anyone who finds it difficult or awkward to refrain from using the word "insects" whenever there are any spiders around may be comforted to know that leading dictionaries both in this country and England permit one to speak of spiders and certain others of these creatures as insects.—Ed.

* * *

Sirs:

In Dr. Wissler's excellent article, "The Domestication of Animals" in Natural History for May, I note that, following the usual assumptions, the domestication of elephants is assigned one point of origin, in southeastern Asia.

These usual assumptions are that elephants were first tamed in India some time between the Aryan invasion (*circa* 1500 B.C.) and the invasion by Alexander the Great in 327 B.C.

There is a line in the famous Babylonian epic known as the *Gilgamesh* which, if the Leonard translation is correct, implies that elephants may have been domesticated earlier, in Iraq. When the hero Gilgamesh is denouncing the goddess Ishtar, he says:

"Keep thy gifts to thyself! . . .
Thou art like a back-door
Which keeps not the storm out,
Like a palace which slayeth the heroes,
Like an elephant who shakes off his carpet. . . ."

Elephants don't make their own carpets, so this refers to a domesticated elephant. The most complete extant version of *Gilgamesh* is from the seventh century B.C., but the materials of which it is composed are supposed to go back to 2000 B.C. or earlier. And back before Hammurabi's time [about 1900 B.C.] there had been wild Asiatic elephants in Iraq.

Now, was this reference to elephants inserted into the *Gilgamesh* in Ashurbanipal's time [seventh century B.C.], by an Assyrian anthologist who had heard about the elephants of India? It seems unlikely, because if elephants were unfamiliar to most Assyrians, they would hardly be mentioned so casually. To one who had never heard of elephants, such a line would be unintelligible by itself.

The alternative is that the line was part of one of the original stories or poems from which *Gilgamesh* was compiled, composed back in Sumerian times. If this is so, did the Sumerians learn the art of elephant-taming from the people of the pre-Aryan Indus Valley culture, with whom they are believed to have had commercial relations; or vice versa; or did the Sumerians and Indians domesticate elephants independently?

Lt. Comdr. L. Sprague de Camp,
U.S.N.R.
Lansdowne, Pennsylvania

The reference to "an elephant who shakes off his carpet" certainly suggests a familiarity with domesticated elephants in southwestern Asia. But whether the text is old enough to indicate priority over India may be questioned. A monograph entitled "Some Aspects of the Asiatic Elephant in Zoology and Ethnology," has been written by P. E. P. Deraniyagala, Acting Director of the Colombo Museum. In this he states that the earliest association of *Elephas maximus* with man in historic times dates from the days of Mohenjo Daro, and he puts this as early as 4000 B.C. At that time the animal is said to have probably been used both as a beast of burden and as food. It is admitted in Burmese and Singhalese literature that elephant management was first developed into a science in India and thence spread to other countries. But further archaeological evidence will be necessary before the exact sequence of events can be stablished.—Ed.

Cougar

Photograph from Herbert C. Lanks

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LETTERS

SIRS:

How can I pay due tribute to your cover picture for September? It is a sort of sublimation of the very aim of the magazine itself, and it needs no title. It is, in Biblical phrase, "altogether lovely." Noah himself, as he watched from the ark, could have had no fairer picture. The blue, the white dove, and the green olive leaflets make a combination superlative for simple beauty and for the symbolism of the new day. The deluge is over. . . .

PAUL G. HUSTON.

Jacksonville, Florida

* * *

SIRS:

This morning's mail brought your great magazine, and the cover is so beautiful and breath-taking, that I felt I must write to thank you for it. I hope its full meaning may pierce the cinders of the bomb —that stopped the war.

I share my copy with ten in this house, and then it goes to South Dakota to nearly seventy Indian children. They will love its beauty.

KATE LEAH COTHARIN.

Milton, Massachusetts

* * *

SIRS:

Congratulations on your beautiful and dramatic cover for September. Your covers are always most attractive and interesting, but this one is the climax.

AGATHA LAUGHLIN.

El Cajon, California

* * *

SIRS:

I want to tell you how very much I have enjoyed both your very interesting article on Birds of Paradise in the June NATURAL HISTORY and the beautiful exhibit of them in the Museum. They certainly make a gorgeous display. I have seen it three times now, and each time I enjoy it more. The birds' coloring is lovely, unbelievably so.

Thank you so much for both.

ELIZABETH N. KENNEDY.

Tuckahoe, N. Y.

* * *

SIRS:

Among the many interesting things in your magazine, the article "A Toad Is Like This" by Roy L. Abbott in the March number held my attention, partly because, as a boy in New England, I always found the toads interesting and partly because the introduced Tropical American Toad is so common here in Hawaii.

In his article Mr. Abbott states that the toad never eats anything that is not moving. This is not true, I am sure, of the Tropical American Toad (*Bufo marinus*). These quickly gather where any flesh is left. I have often found them in the cat's dish cleaning out remnants left by the cat and also eating and dragging away parts of rats left by the cat. Even while the cat is eating, the toads will gather and come directly toward the flesh as if attracted by odor. Thus these toads, which have become very numerous since their introduction in 1931, seem to be useful not only in getting rid of untold numbers of insects, centipedes, and other small animals but in acting as scavengers as well.

CHARLES S. PUTNAM.

Hilo, Hawaii.

* * *

The following comments are offered by Charles M. Bogert, Chairman and Curator, Department of Reptiles and Amphibians, American Museum of Natural History:

It is not impossible, of course, that some toads have evolved other means of selecting their food or prey, but, by and large, all the tailless amphibians in the adult stage rely upon visual cues in selecting their food. Aquatic salamanders, and possibly tadpoles, may utilize taste, and when animals live in the water there is, of course, no obvious difference between taste and smell. The end-organs for both are commonly placed in the same category as "chemo-receptors."

I am not aware that anyone has demonstrated the presence of a sense of smell in toads. All observations reported indicate that toads detect only moving objects as prey. Studies have been made on the food habits of the Neotropical toad in Puerto Rico, where the creature was also introduced to aid in controlling beetles that were destructive to the sugar cane. The results of this survey indicated that a high percentage of their prey consisted of beetles and their larvae, although other insects were found. We examined the stomach contents of a few specimens taken in southern Sonora and found a preponderence of beetles, although ants, moths, and a few other insects were represented. Also, we found a few grains of corn in a few specimens. We did not interpret this, however, as evidence that the toads had purposely eaten the corn. Rather we assumed that the corn had been picked up accidentally because ants or beetles were eating it and the toads had picked up the corn along with the moving insect.

I do not doubt for a minute, therefore, that the same species of toad in Hawaii has been found cleaning out remnants of food left by the cat. But it is a fair assumption that the food had first attracted insects, probably flies, ants, or beetles, and that the toad was in turn attracted by the moving insects. Similarly, a large toad might easily attempt to catch an insect crawling on portions of a rat and accidentally ingest part of the carrion. I would rather expect the toad to continue swallowing the meat, since I doubt whether it would distinguish between carrion and insect once the adhesive tongue had been thrust out to carry in the morsel that was moving. I am not prepared to vouch for the fact that a toad will pick up buckshot rolled in front of it, but I'd fully expect a toad

Continued on page 344

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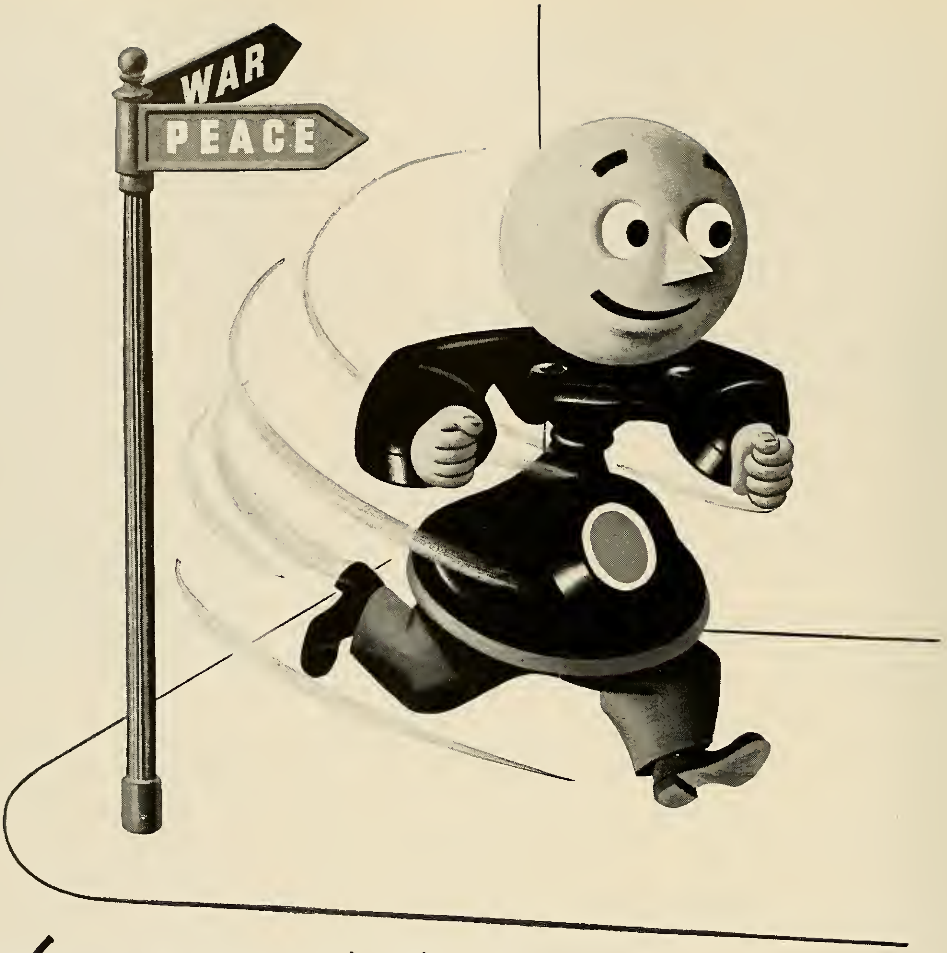

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VOLUME LIV—No. 8 ★ ★ ★ ★ **OCTOBER, 1945**

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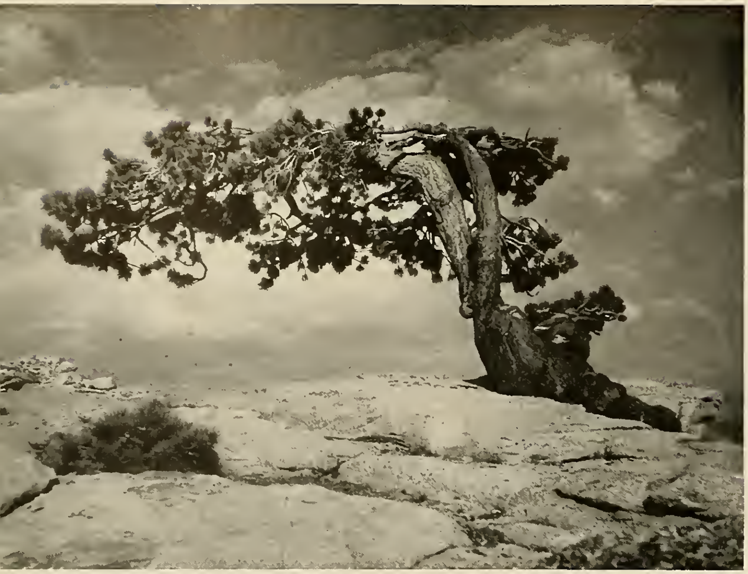

WINDBLOWN JEFFREY PINE

"Is it as clearly in our living shown
By slant and twist which way the wind hath blown"

▲ THIS PICTURESQUE TREE grows on top of Sentinel Dome, 8117 feet above sea level in Yosemite National Park. The photograph was taken by John Henry Coon, who suggests the appropriate lines quoted above from Adelaide Crapsey's poem. Aside from the low shrub in the foreground, the gnarled pine is the only thing growing on top of Sentinel Dome

SIRS:

It was just by chance that I discovered this wonderful magazine of yours. I had to climb 1200 feet to find it in a mountaineering lodge and it is *the* magazine that I have been looking for.

EVA B. STEINER.
Vancouver, B. C.

* * *

SIRS:

This is just to express my appreciation of your very interesting article on Sexton Beetles.

It's the first time I was ever given a clear understanding of how the bugs work, and also I like the human and natural way the matter is written up. You "take the reader along with you."

VAN ALLEN LYMAN.
Balboa, Panama Canal

* * *

OTHER COMMENTS:

". . . Your magazine is the best book on nature I have ever read . . ."

". . . Good work and a wonderful magazine."

* * *

SIRS:

I have been a subscriber to your magazine about fifteen years and have enjoyed practically every word printed in it . . .

During these times when we should try to know and understand our neighbors better, NATURAL HISTORY Magazine is doing a splendid job in giving us a true picture of what other people in distant lands are like.

LADISLAUS C. TURNA.
Clinton, New York

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LETTERS

Continued from page 341

to pick up shot the size of a BB without much difficulty, provided it was moving when seen. Neither would I have been surprised if we had found toads in Sonora that had engulfed Mexican jumping beans; had we collected our toads at the right season of the year I wager we'd have found the peripatetic beans in their stomachs.

Mr. Putnam's observations are interesting, and I am sure that he will forgive me if I suggest that they were possibly incomplete. Unless the toads in Hawaii are a remarkable strain, they must rely upon visual cues. In fact, an amusing story related by Mr. Perviss, who serves frequently as night watchman in the power plant at the Archbold Biological Station in Florida, suggests that a toad may not even be aware of his failures. One evening a stream of the large wood ants (*Camponotus floridanus*) that enter a variety of habitats in Florida, were moving across a wire in the powerhouse in such a manner that their shadows fell plainly on the floor. A toad wandered in at this juncture and spent all of ten minutes, according to Mr. Perviss, "picking up shadows."

It may be added that *Bufo marinus* is one toad of vast economic importance. Not only have they been introduced in Hawaii but in numerous places throughout the tropics, particularly the East and West Indies—virtually every place, in fact, where sugar cane is grown. Largest of all true toads (*Bufo*), the Neotropical species attains a length of over eight inches, exclusive of the legs. Studies on other species indicate that during the active season of the year a toad may completely fill the stomach four times within 24 hours. According to some estimates an individual toad may consume enough insects to save the farmer four or five dollars worth of produce every year. The insectivorous habits of birds have long been appreciated, but except for cane growers, few people have given the toad sufficient credit.

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JUNIOR the CHIMP

SIRS:

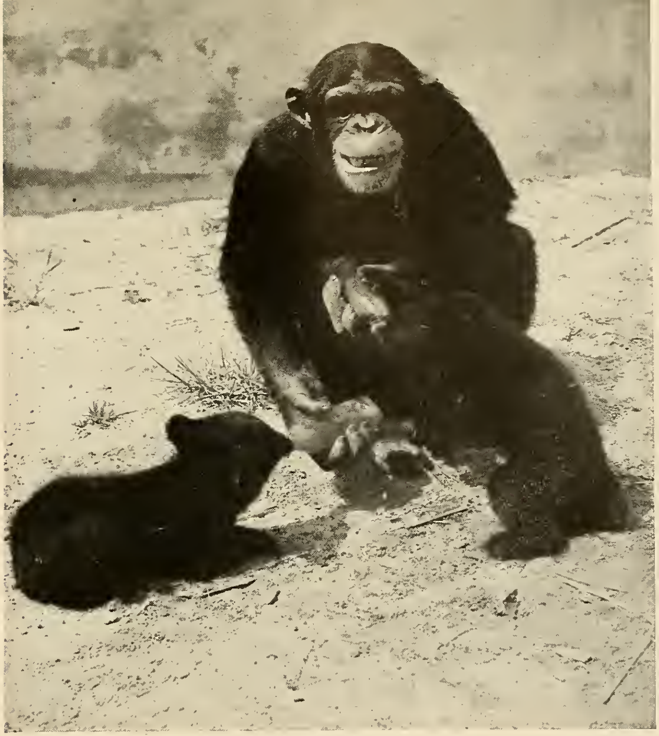
The chimpanzee shown in these photographs was raised from infancy on a bottle, and he readily feeds a pair of black bear cubs in the same way at Benson's Wild Animal Farm at Nashua, New Hampshire. He also frequently enjoys a romp with them. When one of them gets a little too rough and scratches him, he handles it like a man with a hot potato, shifting it rapidly from one hand to the other.

"Junior" also likes the dog shown with him in one of the photographs. They frequently play together but have to be watched, for they both get excited as the frolic progresses. The dog will nip at Junior's hands, and the chimp will then look for a stick or stone as a weapon. If he can't find anything better, he will throw dirt at the dog. One day he picked up a whip that had been carelessly left on the ground and gave the dog quite an expert clip. As far as the dog was concerned, that ended all play sessions for some time. But Junior's real favorite is the raccoon. He will hold and fondle it as a woman does a child, and allow it to crawl up his back and onto his head. Far from resenting it, Junior will aid the raccoon in these gymnastics. Incidentally, the same raccoon likes human beings but fights all other raccoons when placed in a cage with them.

Junior seems to like his keeper, although he has bitten him during his training period. The chimpanzee seems to be quite indifferent to other men and even has an intense dislike for women and children. His brother, incidentally, is quite vicious, illustrating how much difference in personality there is among similar animals.

LAURENCE LOWRY.

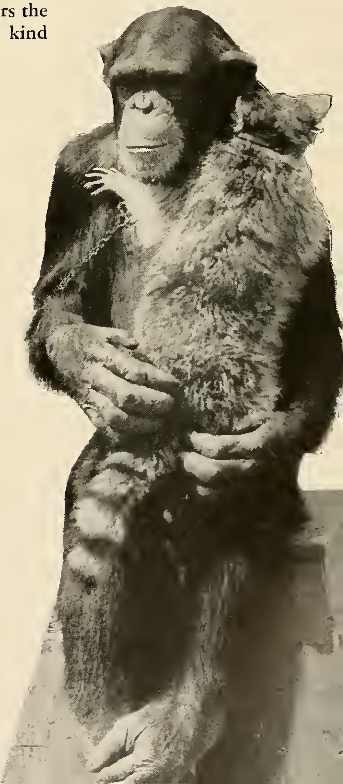
Malden, Massachusetts



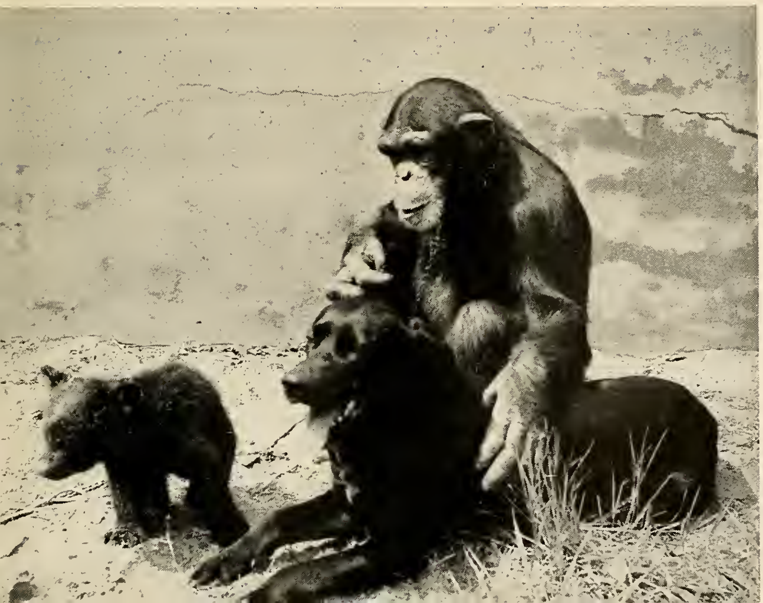
▲ JUNIOR has his hands full feeding two hungry black bear cubs at the same time

Photos by Laurence Lowry

JUNIOR and his pet raccoon, Sharkey, are good friends. Sharkey prefers the chimp to others of his own kind



THE CHIMPANZEE likes the dog when he is well-behaved, but throws dirt at him when he becomes too frisky



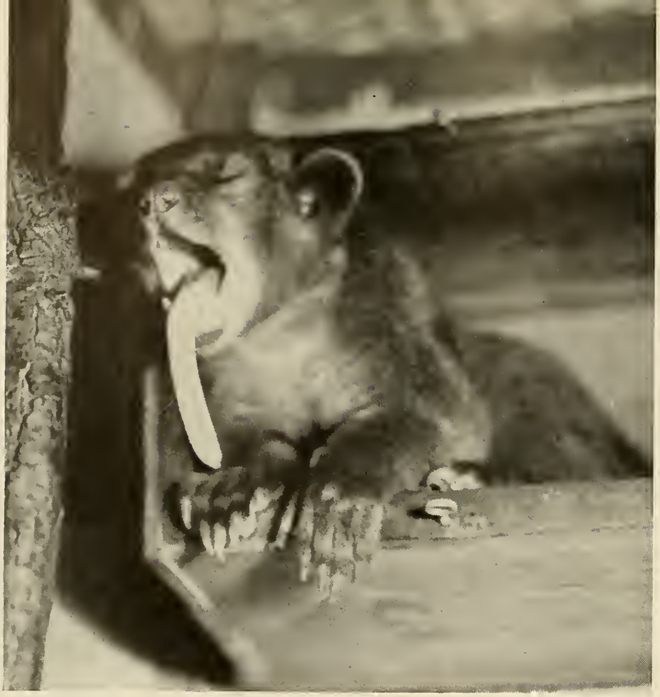


Photo by William J. Evans

The Kinkajou

SIRS:

I think you will agree that a kinkajou's yawn is a thing of wonder and a joy to behold.

Junie, our pet kinkajou, seems to derive great satisfaction from his yawns and consequently begins each period of activity with a half-dozen of the jaw-splitting, tongue-stretching exercises. How he accommodates that stretch of tongue is something we have never been quite able to figure out. Fully extended, Junie's tongue is nearly twice as long as his round head and short, pointed muzzle.

Picture, if you can, the fuzzy brown teddy bear of your childhood, alive and equipped with a long prehensile tail, and you have a remarkably accurate picture of the kinkajou. Owing to their tropical origin (they are natives of Central America and northern South America), kinkajous do not thrive too well in colder climates.

When we first saw Junie in 1942, he was a fuzzy little cinnamon-colored ball in the Mexican town of Tamazunchale. For the first few nights that we had him he cried lonesomely—real shrieks that rose in ear-splitting cadence. He was worse than any baby—that is why we named him Junior, later shortened to Junie.

Junie has lived with us ever since, and supplying him with bananas during war times has been neither easy nor inexpensive. Fortunately, tramp banana boats have arrived in Tampa, Florida, fairly regularly, and our home is within the Tampa trade area.

Junie is our second kinkajou. His predecessor was a female, misnamed Stinker. Actually, kinkajous have virtually no odor. Stinker was nearly grown when we got her and was accustomed to standing up for her rights against a young spider monkey. Junie has never had to stand up for his rights to anybody, although sometimes he shows a marked disapproval of strangers, and he has the dental equipment to enforce his opinions if necessary. We had heard that kinkajous became less tame as they grew older, and that two years was the age when they stopped being friendly. Junie has passed that line and is tamer than ever, if such could be possible.

Kinkajous are nocturnal. They spend the day sleeping in compact balls with all the edges tucked in. When evening comes, they become active and remain that way until morning. Their bare-palmed paws are almost as useful as a monkey's hands, and may be employed equally well for climbing and for grasping.

Junie prefers to dine while lying on his back, balancing his food on the sole of one hind foot and holding it in place with both forepaws. Junie eats many things besides bananas—carrots, potatoes, papayas, oranges, string beans, apples, and bread. His tribe is supposed to be omnivorous, but he has spurned the few pieces of meat we have offered him and does not seem too keen about eggs.

Little seems to have been written about kinkajous. We have learned some things by watching our two, but there are other things we should like to know:

(1) Why are they equipped with the long tongue that makes yawning such a satisfying event? (2) Kinkajous make their homes in trees, but how many kinkajou babies are in a litter, and in what season of the year are they born? (3) Is there anything unusual about the animal's digestive system? Junie's digestive processes are remarkably rapid. (4) And what are kinkajou habits in the wild?

EDNA H. EVANS.

Lakeland, Fla.

In answer to these questions, the following information is given by George G. Goodwin of the American Museum's Department of Mammals:

It is usually some outstanding characteristic that focuses attention on a particular species of animal and thereby brings out many interesting facts about the creature. The extraordinary long tongue is not the only strange peculiarity about the kinkajou. His long prehensile tail serves not only as a fifth hand used for grasping and holding onto the branches of trees, like that of the South American monkeys, but is actually used to reach for things beyond the range of his hands and feet. Thus, fruit may be picked and carried to his mouth clasped in the prehensile tip of this remarkable tail.

Once in his native surroundings, the treetops, nothing can shake him down—not even a tornado can break the stranglehold of his four feet and his tail. Strangely enough this meek and mild creature really belongs in the Order of Carnivorous Mammals, but somewhere back in geological time his ancestors gave up the practice of slaughtering and turned to fruit for a livelihood.

The long tongue of the kinkajou is a special adaptation for the frugivorous diet. With it he can clean out the pulp of any fruit in a far more efficient manner than we can with a spoon. Some of the fruit-eating bats also have long, extendable tongues. Fruit, as we all know, is readily digested and passes quickly through the digestive tract.

The kinkajou is one of the gentlest and friendliest of all wild creatures. It shows little resentment when captured and soon becomes docile and easy to handle. Its token of affection is to wrap its tail securely around your neck, and the animal is extremely annoyed if any liberties are taken with this sensitive appendage.

The kinkajou spends its life in treetops and uses a hollow tree as a den in which to pass the daylight hours. Small parties or family groups attracted by ripening fruit will re-visit the same trees night after night while the crop lasts. They often retrieve fallen fruit from the ground and are somewhat quarrelsome over choice fruit, uttering squeaking noises, coupled more rarely with short barks.

Like most animals that live in tropical countries, the kinkajou does not have a fixed breeding season. A pair in the Milwaukee Zoo had two young in the latter part of September—apparently the only young ever born in captivity. Although the kinkajou reaches maturity in less than two years, this pair lived as mates under ideal conditions for nine years before the female gave birth to twins. As for the average span of life, a nine-year-old kinkajou should be well past his prime, but an old patriarch in the London Zoo lived nineteen years and at that grand old age was still in good health.

YOUR NEW BOOKS

HUDSON HIGHLANDS • HAWAIIAN INSECTS
PLANT GROWTH • CULTURE CHANGE

PLANT GROWTH

- - - - - - - by L. Edwin Yocum

Jaques Cattell Press, $3.00
203 pages, 25 figures, 16 plates

THIS useful book answers many of the questions that enter the minds of those amateur horticulturalists who refuse to accept blindly the dictatorial planting directons on seed packets, or whose interests extend beyond the mere production of a fine display of flowers, to the growth functions of plants and their relationships to their environments.

Professor Yocum, though he has necessarily culled much of his material from standard treatises, shows that he has kept constantly abreast of recent botanical research by the character of the collateral literature cited at the end of each chapter. Few of the matters discussed can be caviled at: Certainly the present scientific attitude toward the new insecticide DDT is much more cautious and reserved than is suggested by the mildly enthusiastic comments in the book (page 101). The much popularized thesis advanced by the author of *Plowman's Folly* remains discreetly undiscussed. One reads merely that "plowing and cultivation keep the soil loose . . ." (page 158), and "Hoeing and cultivating soil . . . appears to have no merit in a direct way, but . . . increases . . . absorption of rainfall, . . . aeration of the soil, destroys weeds, and probably increases the bacterial action in the soil." The moldboard plow, condemned by Mr. Faulkner, is not even mentioned.

Among the many items brought out in the book that attract notice, mention might be made of the continuity of life in moss and fern plants, their ability to continue developing and growing at one end while the old hind end dies and decays, making some of them possibly older than the oldest living trees (page 66). There is also a historical picture of the background of Gregor Mendel, the Austrian monk who discovered and partly interpreted the fundamental laws of inheritance. The chapters on hormones, weeds, rest periods of plants, and special considerations of plant growth (Chapter 24) make especially interesting reading.

Some of the line illustrations are the excellent work of Miss Antoinette K. Ketner; others are taken "by permission" from other works. The flatness of some of the half tones may be due to the quality of the paper. There is a glossary and an index.

G. H. H. TATE.

THE DYNAMICS OF CULTURE CHANGE

- - - - by Bronislaw Malinowski

Yale University Press, $2.50

PROFESSOR MALINOWSKI, whose death in 1943 removed from anthropological ranks one of the most trenchant of thinkers, is widely known for a series of books based upon his field work in the Trobriand Islands. Many non-anthropological readers have read and enjoyed his *Argonauts of the Western Pacific, The Sexual Life of Savages,* and *Coral Gardens and Their Magic.*

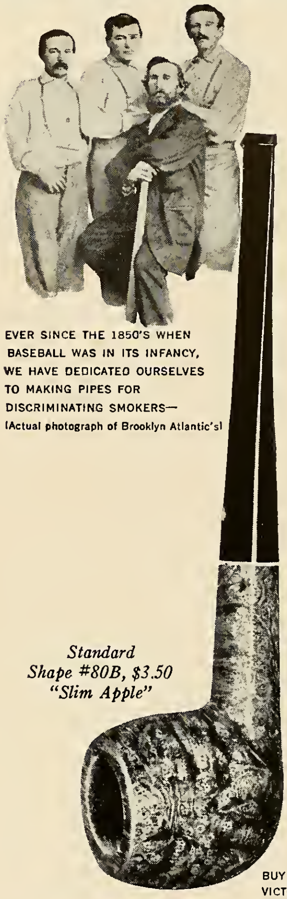
In this posthumous volume, Miss Phyllis M. Kaberry, a former student of Malinowski's, has arranged from his notes and from his various published articles a coherent résumé of his characteristic ideas and opinions on the problem of culture change in the modern world. The text is based on the African scene, but its lessons extend far beyond that continent. The first part of the book, drawing heavily on Malinowski's published articles, presents a vigorous exposition of his views on the nature of culture contact, on the dynamic trends that arise from it, and on the proper methods of studying the phenomena. He shows little respect for the traditional approach—an attitude not unexpected in this protagonist of functionalism in anthropology—and urges the study of cultural phenomena as they exist without reference to the dubious reconstructions of dead and almost forgotten antecedents.

The second half of the book discusses the application of his suggested methods of study to specific problems such as diet, land tenure, warfare, and witchcraft. No one can help being impressed by Malinowski's vigorous argument, and by his profound belief in the practicality of anthropological technique in solving the tangled and complicated consequences of intercultural relationships. Now more than ever we stand in need of such efforts as this to arrive at a workable means of assessing and guiding the results of the increasing interdependence of nations, races, and cultures. Miss Kaberry has rendered Malinowski and the general reader a great service in making her teacher's researches and thinking available in this cogent and accessible form.

HARRY L. SHAPIRO.

Continued on page 387

Ever since the 50's



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Dr. Clyde Fisher, John Kieran, and Fenley Hunter examine the thriving Franklinia tree in Mr. Hunter's garden on Long Island

THE COVER THIS MONTH

In describing the blossom of the Franklinia tree, we have the privilege of quoting portions of John Kieran's column, "One Small Voice," through the courtesy of The New York *Sun*:

"Fenley Hunter is the explorer who discovered the Nahanni Falls—about twice as high as Niagara Falls—away up in northwestern Canada, but that isn't why the Astronomer and I went out to trample over his lawn at Garden City, Long Island.

"It was a tree blooming on the Hunter lawn that was the lure for us. . . . Mr. Hunter showed us an old cannon that he had hidden in the shrubbery and trained along the line of approach to the tree. It was a short, squat, muzzle-loading antique atrocity that the explorer had picked up from a collection of old iron in Bruges, Belgium. . . . Mr. Hunter said he could stuff it with black powder and bolts and nuts and nails and paper wadding and set it off with a flaming torch if necessary.

" 'If I do, probably it will kill everybody in the neighborhood, beginning with me,' said the owner with an air of bland satisfaction.

"The truth about the tree that was in bloom on the Hunter lawn is one of those mysteries of botany in this country. Two centuries ago the greatest botanist in the Colonies was John Bartram, and after him came his son William, who, just after the Revolution, traveled all over the Carolinas and Georgia and Florida on foot and horseback. . . . In 1791 William Bartram . . . described a flowering tree that he had found growing in a certain place in Georgia near the Altamaha River. He wrote in part:

" 'This very curious tree was first taken notice of ten or twelve years ago, at this place, when I attended my father (John Bartram) on a botanical excursion. . . . We never saw it grow in any other place, nor have I ever seen it growing wild in all my travels . . . which must be allowed a very singular and unaccountable circumstance; at this place there are two or three acres of ground where it grows plentifully.' "

Thus the famous Franklinia tree was discovered in 1765; and no one has seen it growing wild since 1790. William Bartram named it *Franklinia alatamaha* in honor of Benjamin Franklin. (Alatamaha is the old spelling of Altamaha.) Fortunately Bartram brought five or six slips back in his saddlebag and planted them in the famous Bartram gardens in Philadelphia. Descendants of those trees are still flourishing in nurseries and private gardens, like that of Fenley Hunter. On Long Island the Franklinia blooms in September, and flowers continue to unfold until frosty weather arrives.

The Astronomer mentioned above is Dr. Clyde Fisher, and we are indebted to him for the color photograph of the blossom.*—Ed.

AN EXPEDITION TO AFRICA

In opening a new program of exploration and research with the cessation of war, the American Museum of Natural History makes known the plans for its first large-scale expedition abroad since 1941.

Mr. Arthur Vernay, Trustee of the Museum, who has sponsored numerous expeditions to remote parts of the world in the past 25 years, will lead the expedition in Nyasaland, South Africa, next April.

In discussing the undertaking, Mr. Vernay pointed out that, "During the war the Museum, like every other scientific institution of its kind, turned over to the forces and agencies prosecuting the war its vast store of knowledge and experience gained through expeditions in every part of the world. Thousands of photographs of obscure islands and coastlines; recordings of ocean depths and currents; climatic conditions; detailed maps on rivers and mountains, and information concerning native peoples, as well as on wildlife and living conditions were all put to the uses of our armed forces. With the beginning of peace we are going forward to help increase that knowledge through new expeditions and research.

Objectives of the Vernay-Nyasaland Expeditions are intensive collections of the mammal and plant life of the region. A district of particular interest is Mount Mlanje, in the wild and mountainous country south of Lake Nyasa. Southern Nyasaland is one of the few remaining parts of Africa offering pioneer opportunities in science. It is believed that valuable information on the relationships of the animals, plants, and climate will be disclosed by the collections and subsequent laboratory study.

Mr. Vernay will be accompanied by Dr. Harold E. Anthony, Chairman and Curator of the Department of Mammals; Mr. Leonard Brass, botanist; and Captain Guy Shortridge, Director of the Kaffrarian Museum of King William's Town, South Africa.

Mr. Brass is an experienced botanist who accompanied the Richard Archbold Expeditions to New Guinea, which in 1939 discovered the hidden "Shangri-La" Valley recently featured in the news. The material he collects will go to the New York Botanical Garden, which is cooperating in the project. Trained natives will assist the expedition in hunting and preparing the material.

The expedition will be in the field for five months, working during the dry season, from May to October of 1946.

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* The "lost" Franklinia was discussed as one of America's rarest trees in the June 1940 issue of Natural History.

Man and the Atom

As the explosions of the first atomic bombs recede into time and the rubble of destruction settles on the scarred landscape, the issues raised by man's use of atomic energy become clearer. The exultation, the joy, and the relief in our minds that we had at last the power and ability to destroy our enemy completely, should he refuse to cease the struggle, are replaced by a profound concern about a future exposed to the uses of atomic energy.

Now that we have it, what are we going to do with it? This question, of course, involves more than the temporary measure of keeping its secrets safe within our own councils, for it is clear that we cannot hope to remain the sole guardian of the scientific knowledge that has made the atomic bomb possible. The basic principles are common property, and it is only a matter of time before other nations will have learned the final steps that we have already mastered. Under such circumstances, it is useless to urge that the knowledge of the means of harnessing atomic energy be obliterated in order to protect ourselves or our successors from their own folly, even if we had the moral right to deny the vast possibilities for good that are inherent in such knowledge.

The consequences, moreover, of attempting to destroy the knowledge of atomic energy, and therefore to declare it by mutual agreement to be a *terra prohibita,* would eventually result in blocking the advance of physics along other and more innocent fronts. Science cannot progress, leaving behind it unknown areas set aside and marked dangerous. Mankind is too comfortably installed on a *de luxe* express named "Science." There are no stops.

It is perhaps salutary, as we contemplate the future, to view this discovery in the perspective of human development. In a very real sense the history of man is the story of an expanding use of energy outside the human organism. The discovery of atomic energy represents only the latest achievement in acquiring sources of energy and thereby devising means of harvesting natural resources for our material and even spiritual welfare. Beginning with the use of fire, man has gradually and with quickening tempo tapped one source of energy after another. With each of these achievements, he has laid open vast areas for good as well as acquired the means of destruction. Fire itself, used by man for perhaps 500,000 years, still requires vigilance and control. Is it conceivable that men should abandon these present powers because of their latent evil? Should we give up our automobiles because they are used recklessly and unwisely by some, our radios because they are possible means of spreading pernicious propaganda, our airplanes because they may carry bombs? Who can predict what alleviations of human misery atomic energy may bring? And although we recognize the dangers, are these benefits to be rejected for fear of its misuse?

There are those who advocate that mankind should first learn moral restraint and social responsibility before being entrusted with undue power. But who shall judge when man will have reached that point in his development, and how may he achieve such virtues in the absence of the responsibilities that force him to acquire them? Moreover, it may be said that man has never been completely ready socially or morally for each new source of power that he has acquired. The apelike beings who first discovered the beneficent uses of fire were no better organized to control it than we who today have within our grasp the vastly greater quotient of energy locked in the atom.

Since, however, atomic energy is here and is likely to stay, it is the solemn obligation of scientists, particularly those concerned with human affairs, and of all men of vision, to work for a political and social organization of mankind that will, by making war impossible, permit us to employ our powers without disaster.

H. L. SHAPIRO,
Chairman and Curator,
Department of Anthropology,
The American Museum of Natural History.

Inside the ATOM

By Willy Ley

The word the Greeks had for it meant "indivisible." Twenty centuries were necessary to show that the atom is divisible and that its energy is great enough to revolutionize peace as well as war

NOTHING in the whole history of human thought has ever received as wrong a name as the atom. Both the idea of its existence and its name originated in the world of Classic Greek philosophy. The word that is the root for our word "atom" is the Greek *atomos,* which means "indivisible." Even the man on the street now knows that nothing divides more spectacularly than the atom.

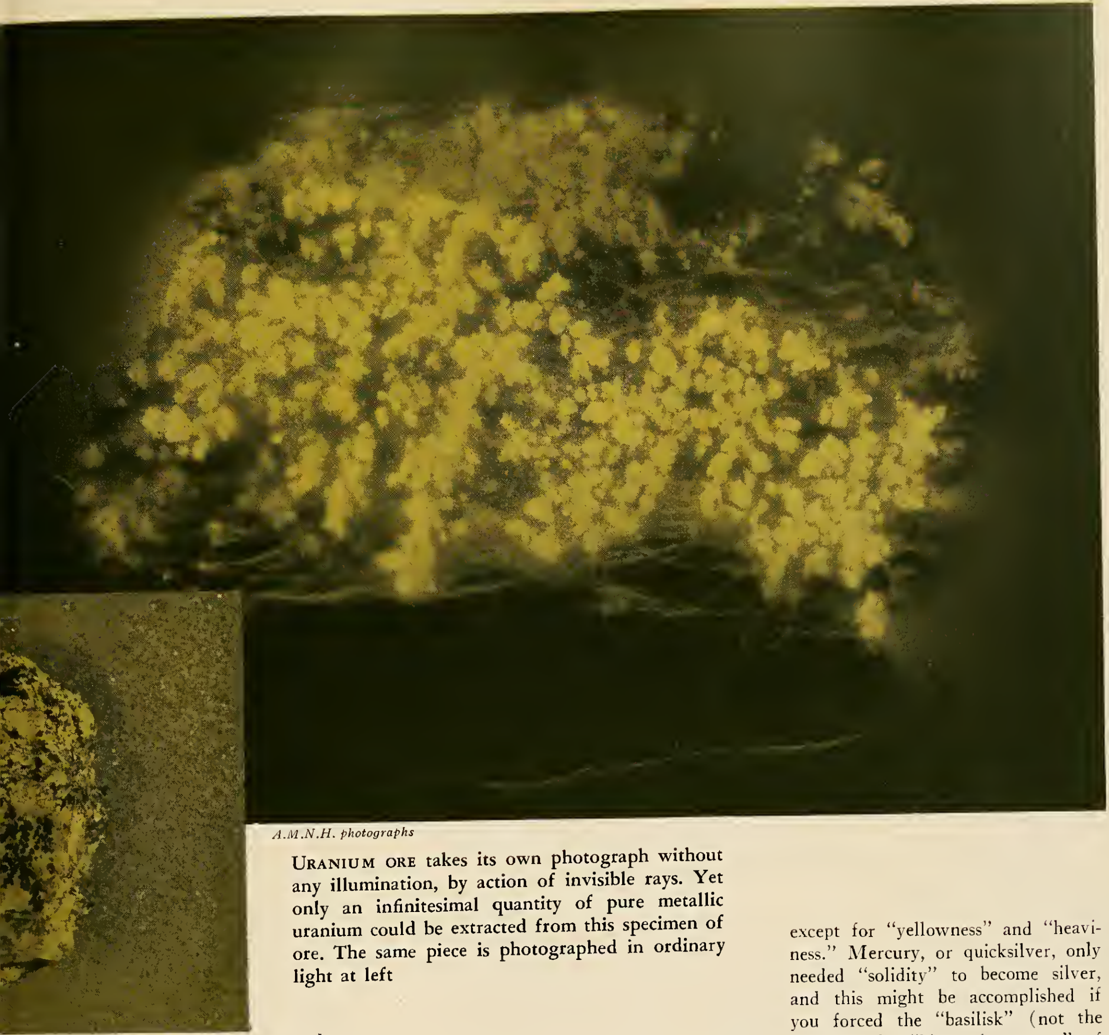
The weapon that helped to blast Japan out of the war with two enormous blows depends upon the explosion of these "indivisible" particles, which contain the most incredible amounts of energy.

Like all ideas, the concept of the atom as the ultimate particle of matter grew from small and simple beginnings. The best way to understand what has been done during the last four years under extreme secrecy in American laboratories is to trace the growth of that idea. The "father" of the atom was a Greek natural philosopher, Democritus the Abderite, who was born in Abdera in Thrace in about 460 B.C. That he followed, in part, the teachings of one Leucippus who lived about half a century earlier should not detract from his glory.

Students at the time of Democritus were groping for an explanation of the basic differences between various substances. Democritus argued that all substances must consist of a number of fundamental pieces. Thus the idea arose that water was composed of particles that were very round and smooth (as we would say, like small polished steel balls) and therefore easy to part, while the atoms of iron were rough and therefore difficult to part. Atoms of acid were supposed to be covered with little hooks which made them sharp and grasping.

These particles differed in shape and arrangement and possibly in magnitude and weight. Also they were capable of movement. But their chief peculiarity was that they were indivisible. Each was so small that it could not be reduced further; hence the word "atom."

All this sounded reasonable enough, and the idea of indivisible atoms retained its validity with but little change until half a century ago. People assumed that there had to be an



A.M.N.H. photographs

URANIUM ORE takes its own photograph without any illumination, by action of invisible rays. Yet only an infinitesimal quantity of pure metallic uranium could be extracted from this specimen of ore. The same piece is photographed in ordinary light at left

irreducible particle, and atoms filled the bill.

It should be remembered that Democritus' atoms were purely philosophical and not supported by any experimental evidence. They were as much the product of belief as of reasoning; therefore, nobody was obliged to accept their existence. Aristotle had no use for them, and while his biting criticism failed to kill the idea of atoms once and for all, the atomists did not rise to a dominant position in natural philosophy and remained but *one* philosophical school among many.

Throughout the Middle Ages the idea remained static. The alchemists did not like "unchangeable" atoms, because their goal was the transmutation of metals, particularly the making of gold from baser elements. Some alchemists, to be sure, had idealistic goals such as the *aurum potabile*, or "drinkable gold," which was to cure all ills. But most of them were content to try for solid gold, stating euphemistically that they were looking for the Cure for the Great Illness of Poverty.

They had their own theories to go by. Chalk, for example, was thought to be the same as sulphur, except that chalk lacked "yellowness" and "combustibility." If you could impart "yellowness" and "combustibility" to chalk, you would have sulphur. Likewise, silver was the same as gold except for "yellowness" and "heaviness." Mercury, or quicksilver, only needed "solidity" to become silver, and this might be accomplished if you forced the "basilisk" (not the same as the "king of serpents" of medieval zoology, but a demonic concept) in the mercury, to part from it. If in addition, you could impart "yellowness," say from sulphur, you would have gold.

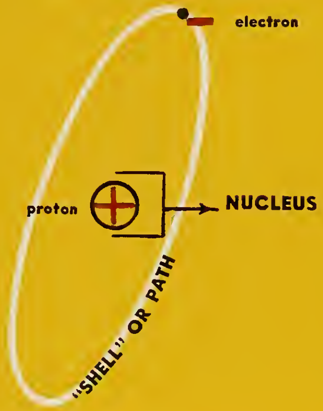
In the course of time, theories of alchemy disappeared to make room for other ideas which, although wrong in themselves, were much more effective because they led to more systematic experimentation.

Around the year 1800 the time was evidently ripe for the revival of the atoms of old. This was done by an English chemist, John Dalton, whose ideas had been directed into atomistic channels, curiously enough, through the avenue of weather observations. Seeing rain fall and disappear again,

WHAT IS AN ATOM?

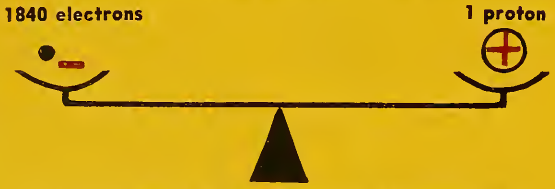
1

A HYDROGEN ATOM has one proton (a positively charged particle) as a central mass, or nucleus. This is balanced by one electron (negatively charged) moving around it



2

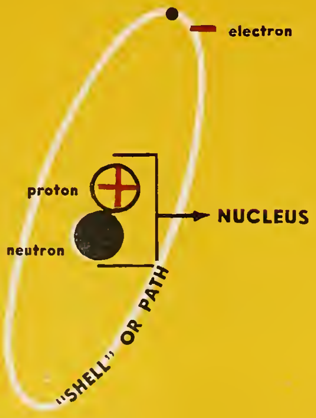
IT takes 1840 electrons to equal the weight of one proton



The whole atom is so small that it is far beyond the range of the electron microscope

3

BESIDES ELECTRONS and protons there are also neutrons, particles that are neutral in the electric sense but have weight. If there is a neutron in the hydrogen nucleus, we have "heavy hydrogen," which forms "heavy water"



Dalton could think of no other explanation than that both water and air consisted of tiny separate particles; otherwise the evaporating water could not enter the air. Observations in the chemical laboratory helped this idea along. Hydrogen and oxygen combined to form water always in a given and rigid weight ratio, no matter how it was done.

After enough facts of this kind had been amassed, Dalton was able in 1808 to write the following:

"These observations have led to the conclusion which seems universally adopted, that all bodies of sensible magnitude, whether liquid or solid, are constituted of a vast number of extremely small particles, or atoms of matter, bound together by a force of attraction, which is more or less powerful according to circumstances. . . . Chemical analysis and synthesis go no farther than to the separation of particles one from another, and to their reunion. No new creation or destruction of matter is within the reach of chemical agency. We might as well attempt to introduce a new planet into the solar system, or to annihilate one already in existence, as to create or destroy a particle of hydrogen. All the changes we can introduce consist in separating particles that are in a state of cohesion or combination, and joining those that were previously at a distance."

Dalton's words became the basis of chemical thought for a full century, and still hold true for chemistry proper. He said, in brief, that all chemical elements consist of minute particles that cannot be subivided further—in other words, atoms. These atoms could form an enormous number of combinations with one another. The smallest possible particle that represented such a combination then recevied a new name, molecule (meaning "small bundle") and the customary classroom explanation sounded like this: By mechanical means, as for example through evaporation, you can divide and subdivide a droplet of water until you arrive at a very small quantity, the water molecule, that can no longer be subdivided and still be water. If you take that molecule apart, you no longer have water but only the elements composing it—in this case, two atoms of hydrogen and one of oxygen.

It rapidly became clear that the atoms of the elements were not all of the same weight. The atom of hydrogen had to be lighter (and presumably smaller) than that of carbon. The carbon atom, in turn, was lighter than the oxygen atom, and the oxygen atom lighter than that of silver. The weight of the atom did not, however, determine the weight of the substance. The atom of gold, for instance, is lighter than the atom of lead, though gold itself is heavier than an equal volume of lead. The atoms of gold happen to be more closely packed.

The relative atomic weight of hydrogen was arbitrarily called "1," and the carbon atom was found to be about 12, that of oxygen almost precisely 16, silver about 108, gold about 197, and lead about 207. These weights were only approximate, but the differences were small. And the English chemist Prout, as early as 1815, ventured the guess that these small differences might be merely mistakes and that all the elements were probably just combinations of various numbers of hydrogen atoms.

This sounded intriguing, especially since it recalled another guess of the alchemists, namely that there was a primary substance, a *prima materia,* of which all other substances were composed. But Prout's idea could not be proved, because the small "mistakes" were stubborn and persistent. Sometimes the figures underwent slight changes when improved methods were used, but they never became the even figures that Prout's guess demanded.

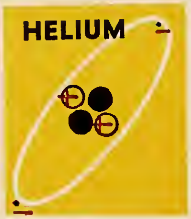
Later in the century, however, a different type of progress was made along similar lines. Two chemists set out, independently and at about the same time, to arrange the known elements in a logical order according to their atomic weights. They finally succeeded in doing this by leaving a few holes in their tabulations, holes which they hoped and predicted would be filled later by the discovery of additional elements. That was in 1869, and the names of the two men were Lothar Meyer and Dmitri Ivanovich Mendelyeev. Both came to about the same conclusions, but Mendelyeev's name became attached to this Periodic System of the Elements, mainly because he had made several very good predictions about the then unknown elements. One after another, the holes in the table were rapidly filled in, but one of the newcomers was so unusual that it looked for a moment as though the whole Periodic System would have to be thrown out on its account.

That newcomer was radium. The

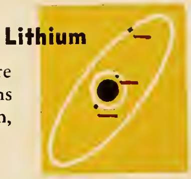
KINDS OF ATOMS

THE ELEMENTS, such as gold, silver, oxygen, etc., have long been considered the basic substances that cannot be separated into different substances, only combined with each other to form compounds

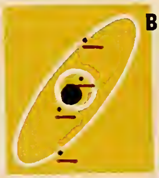
Each element is made up of its characteristic atoms, which differ in the number and distribution of their electrically charged particles



THE HELIUM ATOM IS almost as simple as the hydrogen atom. But it has two positive protons in the nucleus and two electrons to balance them. Its greater weight, however, shows that the nucleus has also two neutrons

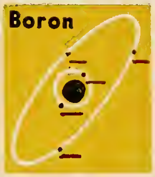


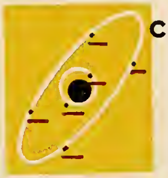
LITHIUM has three protons in the nucleus (here shown simply as a solid body). The three electrons that balance them cannot all get on the inner path, or "shell." One of them is farther out



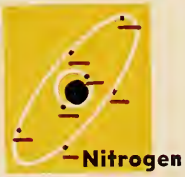
BERYLLIUM has two electrons on the inner path or "shell" and two on the outer one To balance these four electrons, there must be four protons in the nucleus. The beryllium atom is therefore heavier than that of lithium and helium

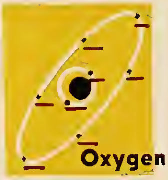
BORON has five electrons on the two paths or "shells." These "shells" can accommodate a total of ten, and when they do, the atom is said to be "satisfied." The boron atom is not "satisfied" and therefore will readily combine with other elements

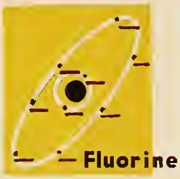




CARBON has a total of six electrons (negative particles) in the two shells. They are balanced, of course, by six protons (positive) in the nucleus

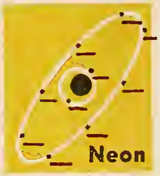






NITROGEN, oxygen, and fluorine have seven, eight, and nine electrons respectively. The same number of protons balance them in each case

NEON has all ten electrons that can be accommodated on the first two paths or "shells." It is therefore "satisfied" and is a chemically inert element



name itself, derived from the Latin *radius* ("ray"), described its main peculiarity. It was then found that other substances also gave off radiant energy. One of these was uranium, atomically the heaviest of all known elements and therefore number 92 in the table. It was named uranium in 1789, the year of its discovery, because the planet Uranus had become known some eight years earlier and Klaproth, the discoverer of uranium, meant to honor the astronomical discovery by transferring the name of the new planet to his new element.

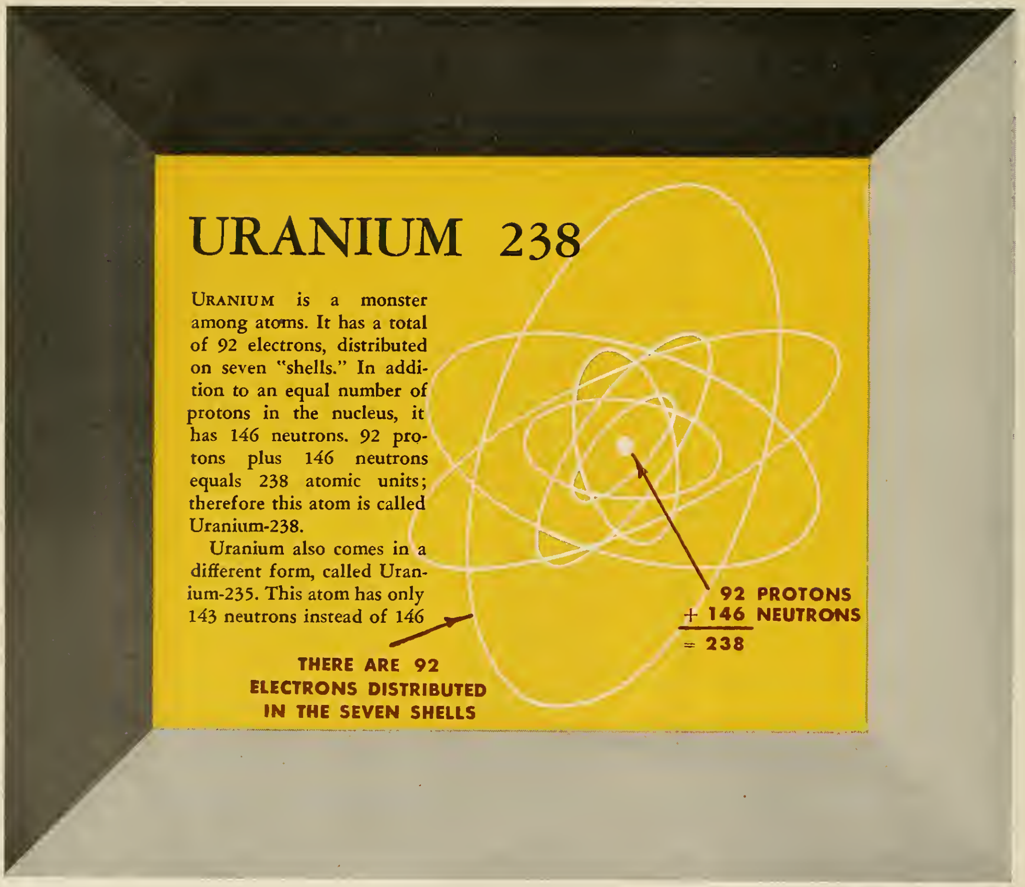
A new science sprang into being at the beginning of the present century, the science of radioactive substances. John Dalton had not been able to explain evaporation without assuming that all matter consisted of tiny particles. Radioactivity now compelled its investigators to assume that the very heavy atoms at the upper end of the periodic table emitted still smaller particles. It seemed that these very large atoms,—those of radium, actinium, uranium, etc.,—had grown too large to hold together very well. They decayed and in decaying gave off radiation, which is energy in the form of particles smaller than an atom, subatomic particles.

Sir William Ramsay, one of the investigators of the new mystery, could not refrain from writing a poem, which he titled "The Death Knell of the Atom":

> *. . . So the atoms in turn, we now*
> *clearly discern*
> *Fly to bits with the utmost facility;*
> *They wend on their way, and, in*
> *splitting, display*
> *An absolute lack of stability.*

Electrical research tied in with these discoveries of the instability of the heavy atoms. Physicists had arrived at the conclusion that electricity was discontinuous, that it had to consist of particles of some kind. A flow of electricity was not like the steady beam from a searchlight, but rather like the stream of bullets from a machine gun. The smallest particles were called electrons, from the word the Greeks had for amber, the substance which when rubbed would pick up bits of paper.

These negatively charged particles (electrons) turned out to be one of the building stones of the atoms. It was a logical sequel that there must be particles having an opposite or positive electric charge, but although their manifestations had been discovered as early as 1886, they were not named until 1920. They were called protons, and it can be remembered that they are positive because both words begin with "p." It was found that these protons, while carrying a positive charge of the same amount as an electron, were much more massive. The best figure at pres-



URANIUM 238

URANIUM is a monster among atoms. It has a total of 92 electrons, distributed on seven "shells." In addition to an equal number of protons in the nucleus, it has 146 neutrons. 92 protons plus 146 neutrons equals 238 atomic units; therefore this atom is called Uranium-238.

Uranium also comes in a different form, called Uranium-235. This atom has only 143 neutrons instead of 146 ent says that one proton has the mass of 1840 electrons.

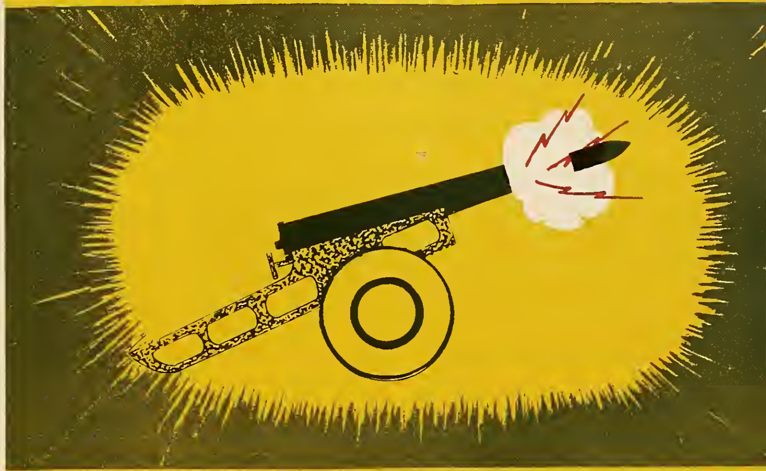
It was about that time that Niels Bohr evolved his famous theory of atomic structure. While there have been other attempts to describe the atom, Bohr's has best stood the test of time, and it is the only one that is easy to visualize. According to his theory, an atom can be compared to the solar system, in which the various planets move in curved paths around the sun. In the center is the main mass, the nucleus or heart of the atom, carrying one or more positive electric charges. Around the nucleus whirl planet electrons, as many as are required to counter-balance the positive charge of the nucleus. We might say that the atom is a positively charged mass surrounded by a veil of negative electricity.

Now the mass of one proton is just about the same as the mass of a hyrogen atom. Therefore it was reasoned that a hydrogen atom consisted of one proton in the nucleus, circled by a single tiny electron.

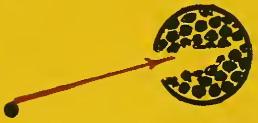
Hydrogen is element number 1 in the atomic table, with a weight of 1.008. Element number 2 is helium, with a weight of 4.003. But the nucleus of this atom, also called alpha particle, carries only two positive charges electrically balancing its two electrons. This would add up to only little over half the known atomic weight of the helium atom. Apparently there had to be a mass in the nucleus without any electric charge. It was at this point that a suggestion made by Lord Rutherford of Nelson in 1920 proved useful. Rutherford had suggested the existence of a subatomic particle called a neutron—in other words, a particle that was neutral in the electrical sense. It was said to have the same or about the same mass as a proton, but without any charge. The nucleus of helium, consequently, was understood to consist of two protons and two neutrons, with two electrons moving around it in a single orbit.

Element number 3, lithium, has an atomic weight of about 7; hence its nucleus contains three protons and four neutrons, with three relatively weightless electrons circling round it. Two of these electrons were the same in position and arrangement as those of helium, but the third electron moved in another orbit farther out. That second orbit, or "shell" as it is known technically, can take up to eight electrons; then it is full, or

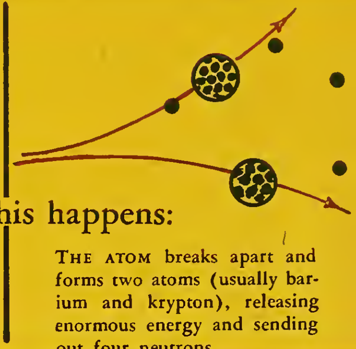
THE BEHAVIOR of radio-active elements suggested how the atom might be smashed. A radio-active atom can be compared to a cannon. The bullet is the so-called alpha particle (or helium nucleus). The smoke is the beta "radiation." And the flash is the gamma radiation



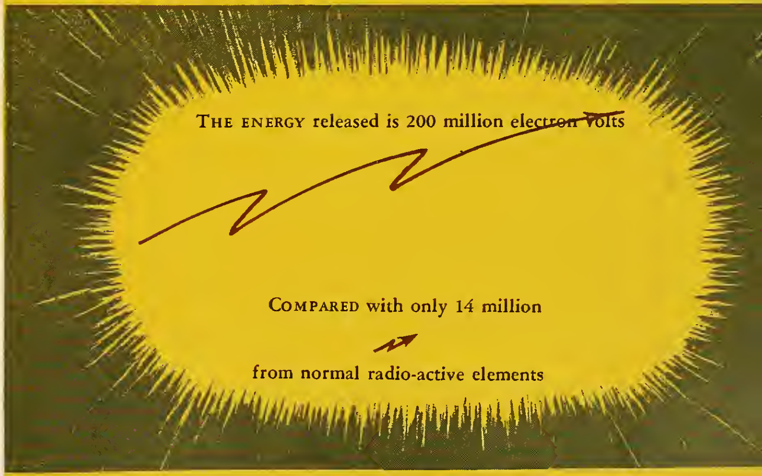
IF a slow-moving neutron is shot at a Uranium-235 atom,



this happens:



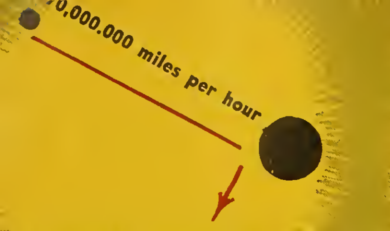
THE ATOM breaks apart and forms two atoms (usually barium and krypton), releasing enormous energy and sending out four neutrons



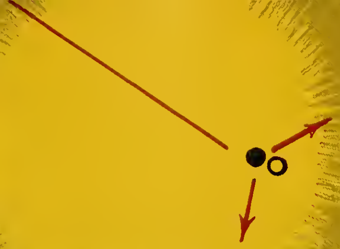
THE ENERGY released is 200 million electron volts

COMPARED with only 14 million

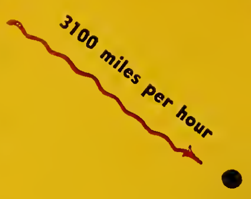
from normal radio-active elements



NEUTRONS are ordinarily fast, and fast neutrons will not break the uranium atom. They merely bounce off without suffering measurable loss of speed



BUT when a fast neutron hits hydrogen atom of about the same weight, the two share the energy



AFTER many bounces, the neutron is slowed down

"satisfied." This is the case with neon (element number 10), in which ten electrons balance a nucleus containing ten protons and ten neutrons, to give an atomic weight of about 20.

Element number 11, sodium, had one more electron still farther out, in a third shell. If the outer shell in any instance is full or satisfied, we have an element that shows no inclination to form any compounds, for instance helium, neon, and with more shells, argon, krypton, and xenon. But if the outer shell is not full, chemical activity results. Sodium atoms have one electron in the third shell, chlorine atoms have seven. These two elements combine very readily. But all these chemical combinations take place in the outer shells; they do not touch the nuclei. Hence atoms go into chemical compounds and out of them again without experiencing any change. If you want to change the atom itself, you have to attack the nucleus.

The attack on the nucleus, popularly called "atom smashing," became the big problem. Obviously, the only way in which one could attack the very small nucleus was to shoot at it with still smaller particles. The behavior of the radioactive elements themselves suggested what might be done. When a radioactive atom convulsed, it shot out an alpha particle (or helium nucleus) accompanied by two types of radiation, called beta and gamma rays. The beta "rays" were streams of electrons. The gamma rays were true radiation, comparable to the very hardest variety of X-rays.

To help us visualize this occurrence, there is a beautiful comparison. The emission of an alpha particle corresponds exactly to the firing of a gun. The heavy alpha particle is like the bullet. The beta "radiation" is the smoke, less substantial and lighter. And the burst of gamma radiation is the flash, impressive but non-material. The same gun, needless to say, was fired back at the atom in the effort to break it.

All the machinery that received newspaper publicity from time to time—the van de Graaff generator and finally the cyclotron—were only atomic cannon. They were machines designed to fire subatomic particles, especially alpha particles, protons and deuterons, into atoms. Physicists learned a great deal while inventing, constructing, and using this machinery. The dreams of the alchemists were realized to some extent: some elements were actually changed into others. Atoms were hit and chipped; but the military significance of these experiments was not too impressive. Most of the time, the damage was only comparable to a hole put through the funnel of an enemy steamer. Only very rarely was an atom really broken up. Especially obstinate in the face of the bombardment were the heavy atoms, which one could assume might ultimately be the most satisfactory targets.

Then, in 1939 and 1940, the great problem was solved, at least in one particular case, the case that led in a straight line to the atomic bomb. The Italian physicist Enrico Fermi, later of Columbia University in New York, working with uranium, made an observation that could not even be explained at first. For a short time Fermi thought that he had discovered a new element. Other researchers took up the trail, and in view of the political events then brewing, the situation became critical, for they were German scientists—Drs. Hahn, Strassmann, and Lise Meitner. Dr. Meitner left Germany and aided the scientists of the United Nations.

They found that what had happened was an absolute novelty. A uranium atom had not simply had pieces chipped off by a subatomic bullet: it had exploded like a torpedoed ship! The nucleus had broken into two pieces of approximately the same mass, sending out streams of energy on an unprecedented scale. Physical science even lacked a term for this performance and had to borrow the word "fission" (a cleaving, or breaking up into parts) from the biologists.

It was the first time that one of the really heavy atoms had yielded, and it had yielded not so much to brute force as to persuasion. Not a fast-moving alpha particle but a slow-moving neutron caused the fission of the uranium atom. But not every uranium atom responded.

It had already been learned that the established elements sometimes masqueraded in slightly different costumes. The so-called "heavy water" that was recently discovered is "heavy" because its hydrogen atom is one of these variant forms. Likewise, in addition to the usual helium 4, there is helium 3, with only one neutron instead of two; and there is lithium 6 as well as lithium 7. Chemically there is no difference, but the atoms have different weights. These variant forms of an element are called isotopes.

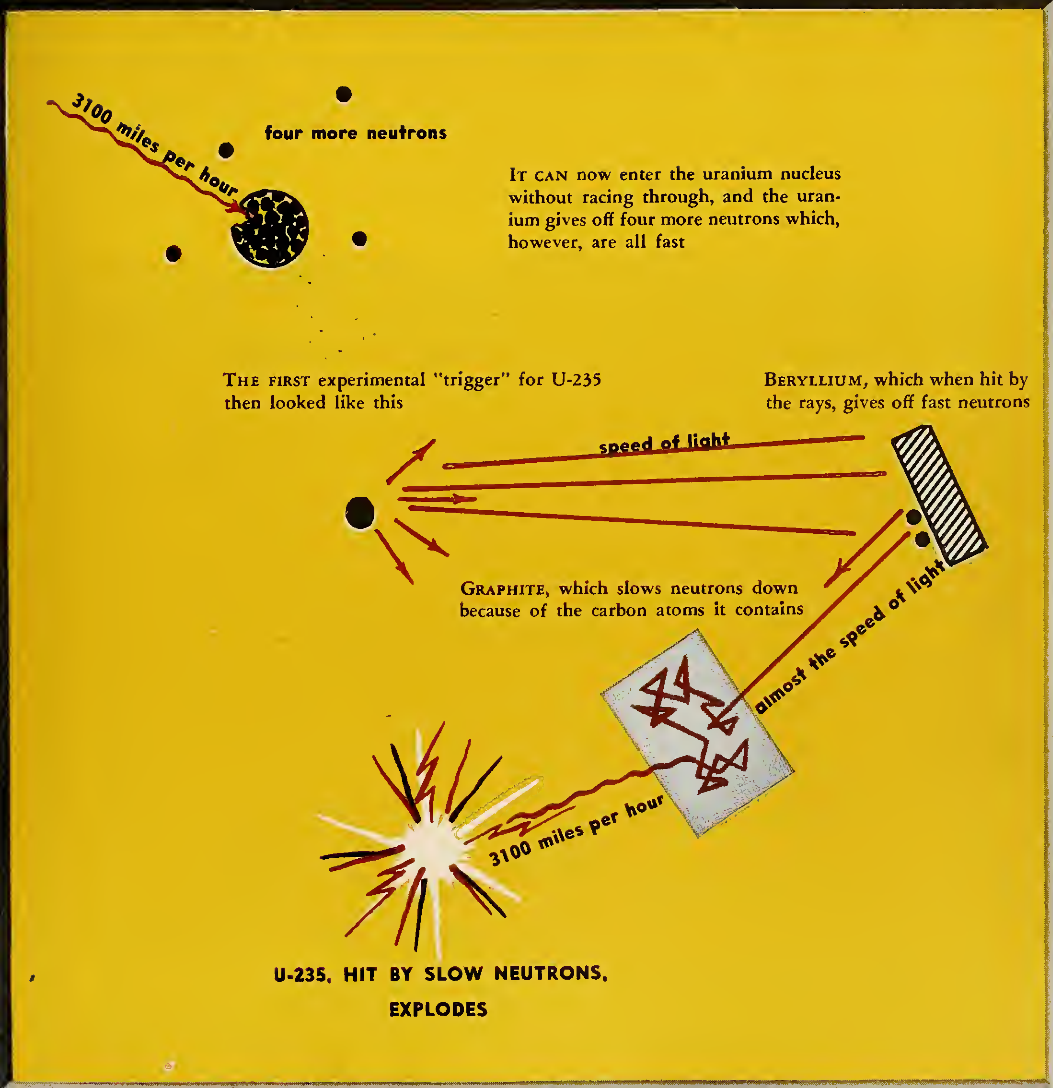
In the case of uranium, there were U-234, 235, 236, 237, and 238, the last being the most common type. U-236 and U-237 are not stable; U-234 is very rare; but U-235 is compartively abundant, one out of every 140 uranium atoms being of this type. And U-235, with 143 neutrons instead of 146, goes into fission as soon as a slow neutron wanders in.

The explosion or collapse (either term applies, depending upon the point of view) is restricted to that one atom. The atom gives off four additional neutrons in the process of breaking up, but these are fast neutrons and therefore do not touch the nuclei of other atoms. It seems that a fast neutron, when it runs into a heavy atom of any kind, mostly just bounces off without apparent loss in speed.

The two problems that arose as soon as these facts were known were: (a) how can one extract U-235 in large quantities from the customary mixture of U-238 and U-235, and (b) how can one slow down those four neutrons that are released so that they will in turn cause other atoms to explode and produce what is called a chain reaction.

The problem of separating U-235 from regular uranium (U-238 plus U-235) was extremely tedious, as can be imagined from the size of the factories that had to be built to make the atomic bomb. There existed, in 1940, an instrument called the mass-spectrograph. It operated somewhat on the principle of a cream separator, the slightly heavier U-238 being separated from the lighter U-235 by means of a magnetic field which affected them differently. But one single mass-spectrograph would have to be kept running 24 hours a day for about 12 million years to sort one pound of U-235 atoms from the necessary amount of purified metallic uranium.

One way would have been to put 12 million machines to work and get a pound of U-235 in one year. To obtain a yearly production of 400



IT CAN now enter the uranium nucleus without racing through, and the uranium gives off four more neutrons which, however, are all fast

THE FIRST experimental "trigger" for U-235 then looked like this

BERYLLIUM, which when hit by the rays, gives off fast neutrons

GRAPHITE, which slows neutrons down because of the carbon atoms it contains

U-235, HIT BY SLOW NEUTRONS, EXPLODES

pounds, the amount the Hiroshima bomb may have contained, would require 4800 million machines.

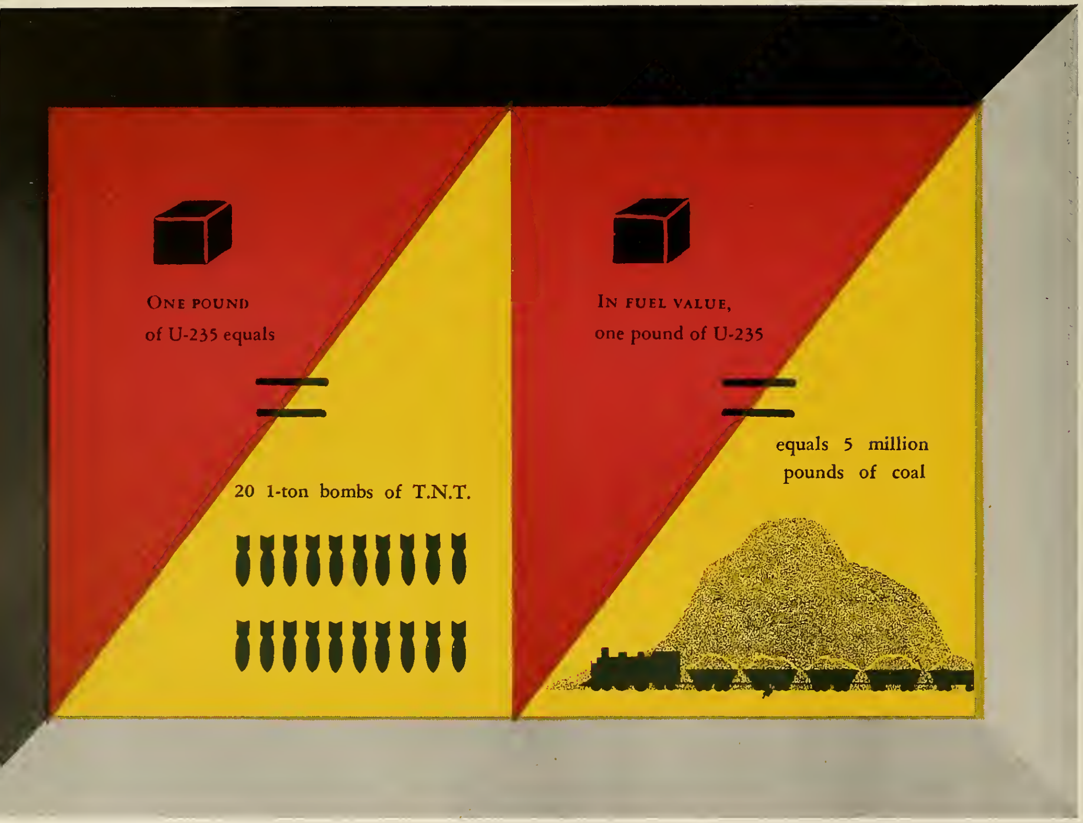
Another possibility (and this was purely hypothetical in 1940) was to do something with U-238 to *convert* it, in some manner, into some other material. Irradiation of uranium with neutrons produced a new uranium isotope, U-239, which does not exist in Nature. This decays into a new substance, called neptunium because the planet Neptune is *beyond* Uranus in the solar system. This substance was not stable. It changed into still another new substance called, for similar reasons, plutonium.

Plutonium, it seems rather certain, is stable to a certain extent and fissionable like U-235. But a difference is hinted at in a cautious report prepared by Prof. Smyth of Princeton University at the request of the War Department. Apparently plutonium fissionizes like U-235 when its mass is small, but once the mass approaches what has been called the "critical size," it will go into atomic explosion. This characteristic suggested an application that could be used in military operations. If enough plutonium to produce an atomic explosion could be kept in separate pieces, so that each piece were well below the "critical mass," and then could be brought together rapidly, the whole would explode with tremendous violence.

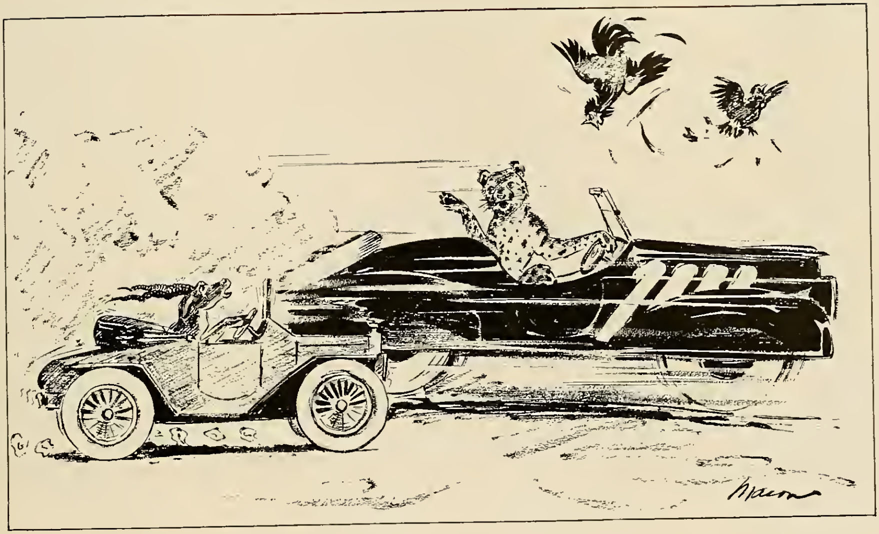
Part of the answer to the second problem—how to produce a chain reaction—is no secret. A fast neutron will bounce off a heavy atom without measurable loss of speed. But if it runs into a light atom, like a hydrogen or carbon atom, which has little more mass than the neutron itself, the bounce is mutual, and the two bodies share the original speed of the neutron. This means that a neutron which has been bounced around in a dense swarm of light atoms for a time will have slowed down enough to set off additional uranium atoms. In practical terms it means that the U-235 should be surrounded by a compound rich in hydrogen atoms, such as paraffin or simply water, or one rich in carbon atoms, such as graphite.

That should create a more or less fuel-like slow reaction, very useful for peaceful purposes, but not suitable for bombs. The method of setting off all the atoms at once remains one of the most closely guarded military secrets.

The bombs which helped to end the War prove that atomic energy can now be used at will. So far, we have only been able to explode the atoms of the rarer isotopes of uranium and its heavier derivatives. In appearance U-235 is a silvery metal, slightly softer than soft steel and about as heavy as gold. Gold has a specific gravity of 19.3, while that of uranium is 18.7. But having found the key to one element's nucleus, we'll probably find the keys to others' too. And the peacetime possibilities of atomic energy are even more boundless than its destructive power in war.



SPEEDY ANIMALS



By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

MANY animals owe their existence to their fleetness of foot. Grass eating creatures must flee from their carnivorous enemies, and the flesh-eaters often must run down their prey.

The speediest mammal is the cheetah. It has been known to run at a rate of 70 miles an hour for short distances. This strange, long-limbed cat commonly overtakes the swift black buck, one of the fastest of the antelope tribe, even with handicaps of as much as 200 yards. The other large cats—leopard, lion, and tiger—are also fast sprinters, but they cannot sustain the pace for long. Even the cheetah slows up considerably after about a quarter of a mile.

After the cheetah, the larger gazelles are runners-up. Dr. Roy Chapman Andrews once chased a herd of Mongolian goitered gazelles in front of his car while the speedometer registered 60 miles per hour. The American prong buck is almost or quite as fast as the gazelles, as clocked by automobile speedometers. Even in a race of 27 miles, prong bucks have been reported to average a speed of 36 miles an hour. Deer are not so speedy; they go through the woods at about 30 miles an hour but cannot keep this up for long.

Race horses rarely run the mile much faster than a speed of 35 m.p.h, but Man O' War once ran at 43 m.p.h for a quarter mile.

The cheetah and antelopes that exceed the horse in speed do not weigh nearly so much, and it is only fair to take the size of the racer into account. It is more extraordinary that a horse and rider can go a mile in about 1½ minutes than that a 100-pound gazelle can run a mile in a minute, because the energy required is much greater. Almost as fast as the race horse are the Asiatic wild asses, also timed by Dr. Andrews, which are reported to run at 40 m.p.h.

The fastest greyhound cannot quite keep up with the best horse, in spite of the great advantage of light weight. Their record rate is 36 m.p.h. This is as good as or better than the speed of any of the wild dogs. Probably the fastest of these is the African hunting dog, which runs down the swift antelopes of the veld. Coyotes, which have a reputation throughout their range for speed, rarely reach a rate faster than 30 m.p.h; and although greater speeds are reported for foxes, the records are doubtful.

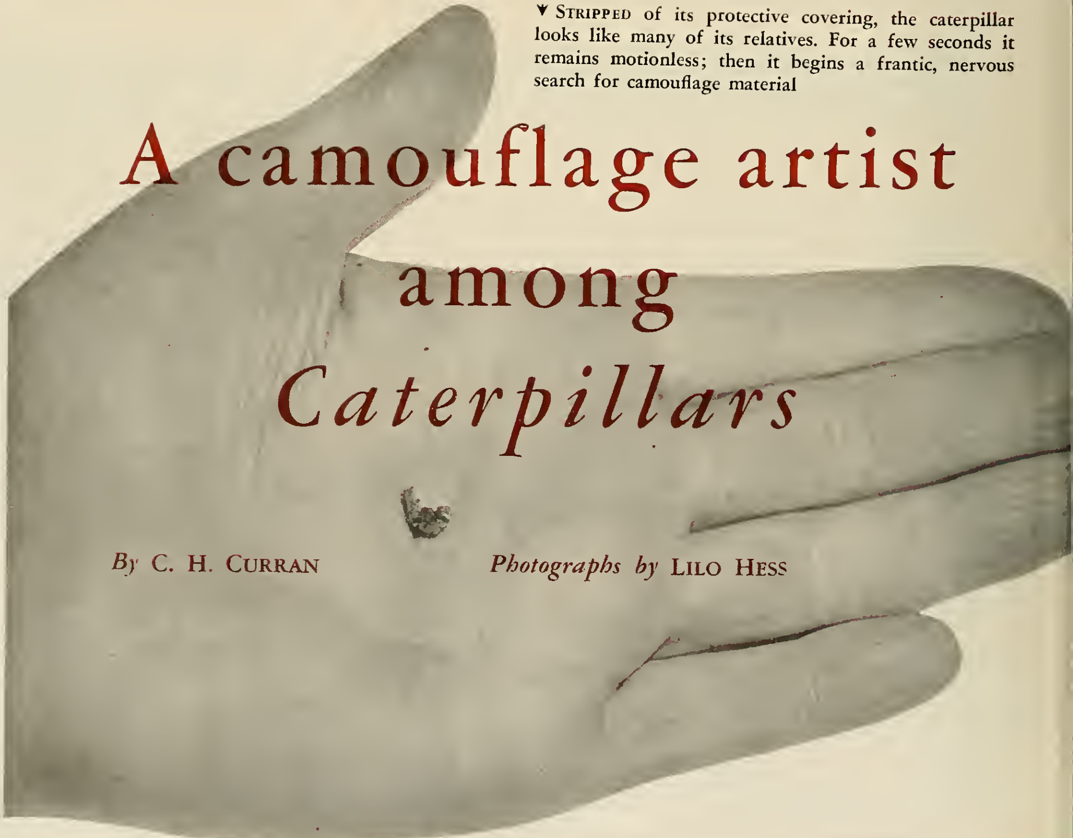
Running ability depends upon many factors: the length of limb-bones, the development of levers and pulleys in the limbs, the strength and contractability of muscles, and the nervous impulses that control the actions of the muscles. The champions and contenders for place are all built for speed, being long-limbed, slender and muscular. But some animals whose limbs are not proportioned for speed are nevertheless able to charge with surprising quickness. It is astonishing to see how rapidly some large, clumsy-looking animals can travel. A rhinocerous has been reported to chase an automobile at 35 m.p.h down a slight incline; and the wart hog, though short-legged and heavy-bodied, is able to run at 30 m.p.h. The African elephant has been timed with a stop watch at 24 m.p.h. for 120 yards, and it weighs four tons or more. The gangling giraffe gallops at some 32 m.p.h., and a charging bison has been reported to go at the same speed.

Human racers do not come out so well. The world record for the eighth mile (starting from rest) is a little over 22 m.p.h. But the sloth and the slow loris (a lemur) are really slow pokes. A sloth hurries at about a half mile per hour, while the natives say that a loris is likely to starve to death going from one food tree to another.

LONG before man began the study of camouflage as a protective measure, many insects had become masters of the art. Among the most proficient of these is *Synchlora aerata*, one of the measuring worms belonging to the family Geometridae.

This is a very common insect, but it is seldom seen in the caterpillar stage because of its habit of concealing its body beneath a shield of leaf fragments.

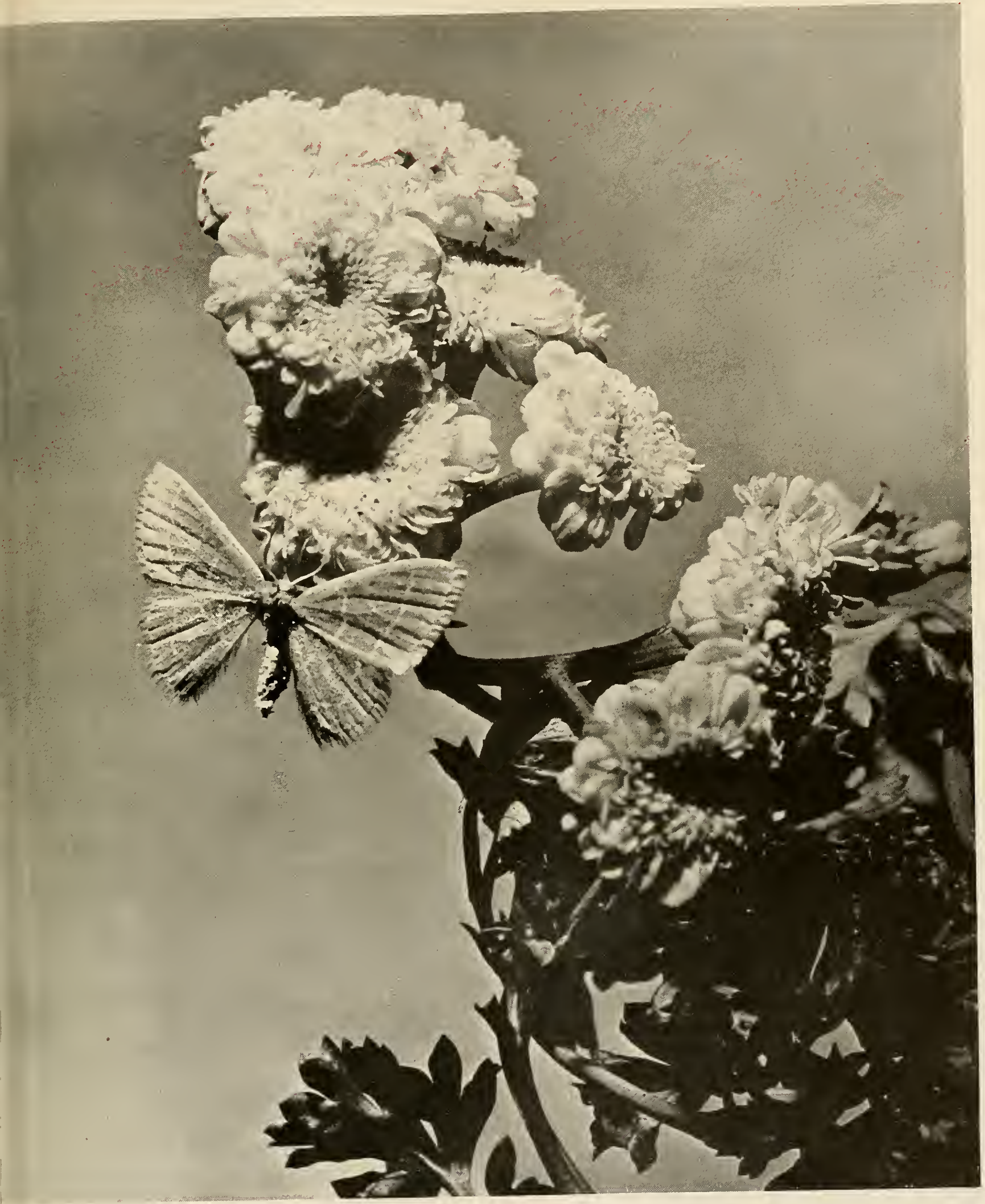
When it becomes a moth, however, it attracts much attention because, though small, it is beautifully colored in delicate green, with faint white lines crossing the wings. It may fly into view as you walk through the fields in the daytime and is frequently attracted to light at night.



▼ STRIPPED of its protective covering, the caterpillar looks like many of its relatives. For a few seconds it remains motionless; then it begins a frantic, nervous search for camouflage material

A camouflage artist among *Caterpillars*

By C. H. CURRAN *Photographs by* LILO HESS

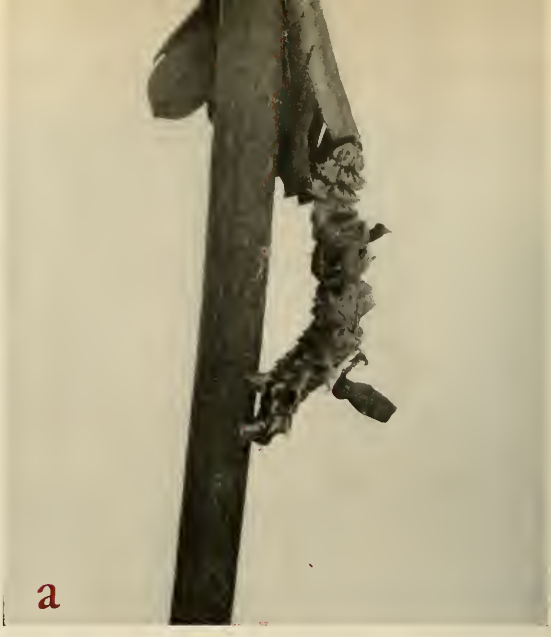


▲ WHEN THE CATERPILLAR becomes a pale green moth, it constructs no camouflage. Though small, the insect is then far from inconspicuous. Here it is shown on a marigold plant

a As soon as the caterpillar finds a leaf of parsley, it begins to bite off leaf fragments and attach them to the spines and tubercles on its body by means of fibers of white silk. It begins this career of deception shortly after birth

b The caterpillar camouflages the hind part of the body first, alternating irregularly from one side to the other. It can twist its body at an unbelievably sharp angle, and thus is able to cover all but the narrow front end

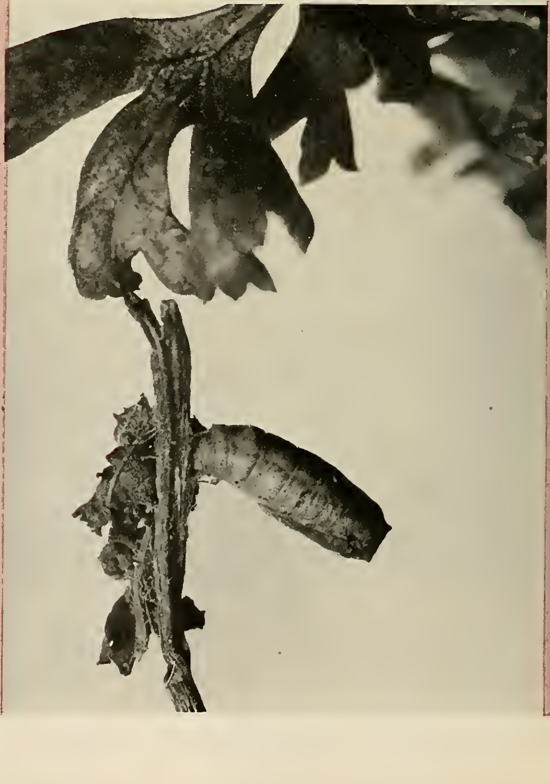
c In less than half an hour, it has completed its task. It rests for a moment on the stem before crawling to the leaves, where it blends perfectly with their fringed edges


a

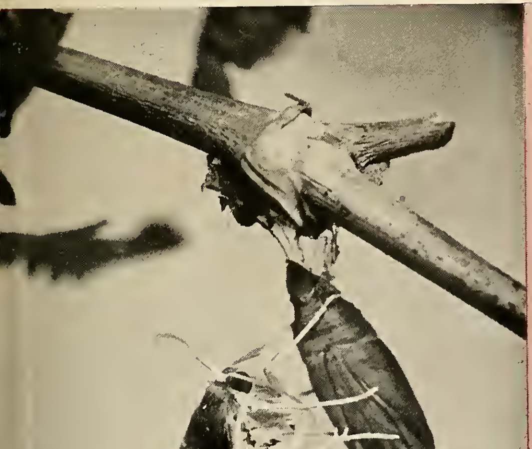
When the caterpillar has completed its camouflage, it may feed on near-by leaves or seek a position among them, where it can sleep with little danger of discovery. Carrying its own concealment, it does not attempt, like most other caterpillars, to hide. Instead, it takes up a position in full view on the edge of a leaf or stem. So well does it fit into its surroundings that, even when one knows it is on the plant, it can be located only after a very careful search. It feeds upon a variety of plants, but perhaps the best place to find it is upon the Black-eyed Susan and common daisy. There it can frequently be observed feeding upon the petals, under a camouflage composed of pieces of them.

The caterpillar's readiness to change its food plant may provide amusement for the collector. Since the effectiveness of its camouflage depends upon the way it blends with a particular plant, the caterpillar can be induced to change its coat quite frequently. It will discard a bright yellow costume made from the Black-eyed Susan for a green one of parsley leaves, or an ensemble of some other color, if the food offered proves suitable. The change usually begins within an hour and may be completed within another half-hour. First the caterpillar bites the silken threads that hold its outmoded camouflage in place and drops them to the ground. Then, piece by piece, it attaches its new coat in position. Portions that in time become discolored or dried are replaced every day or two; otherwise they would not match the surroundings.

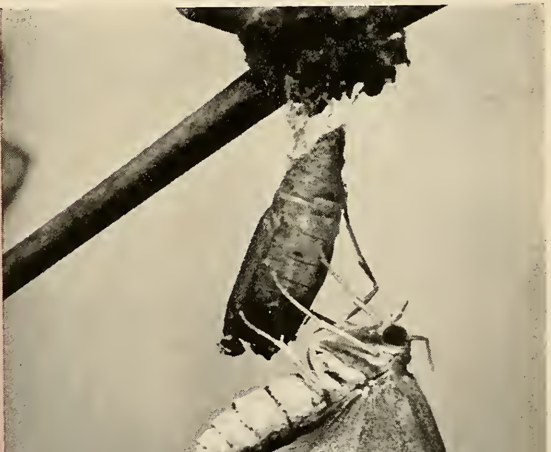
▼ When it is full-grown the caterpillar makes a flimsy cocoon by fastening its camouflage to a stem. In this cocoon it changes to a pupa, which works its way out shortly before the moth is ready to emerge



▼ THE MOTH, with wings expanding from small saclike pads, clings to the pupal case. Liquid is pumped into the wings, and they quickly lengthen and broaden



↘ AFTER THE WINGS have reached full size, the moth must rest for several hours while they harden. The scales on the wings and body are fully colored. At this time the moth is quite helpless; but when dusk comes, it will fly away in search of nectar. This it obtains from a wide variety of plants, but daisies are a favorite source



THE WATERS BENEATH

Things are not always the way they appear to be on the surface—and water is no exception. The location and conservation of subsurface water is vital to the economy of innumerable American homes, farms, and ranches

By WILLIAM H. CARR

A NUMBER of automobiles lined up waiting, bumper to bumper, on either side of a raging torrent that swept straight out of the gray-green desert. One of the cars had even been overturned some distance from the road. So suddenly had the rushing water descended that the vehicle had been literally washed into the desert before the driver could avoid the surging currents. Five minutes before, this spot on a main Arizona highway had been as dry as the neighboring wilderness of heat-bitten cactus that stretched to the horizon and beyond. Now it was a raging flood. And yet, among the delayed and irritated travelers, it is probable that few, if any, were aware of the less spectacular but profoundly more serious danger of which the waters were a dramatic but incidental manifestation—a danger not to automobiles but to human welfare.

No dam had burst, and no underground river had suddenly risen to enjoy a rampage. It was a flash flood. In this arid country of Santa Cruz, such floods come whenever torrential rains deluge the desert and surrounding mountains. Owing to the ground's poor powers of absorption, the water, with nothing to restrain it, simply rolls off as quickly as it falls. Tiny rivulets find larger streams, and soon, in some aged wash or arroyo, there is a full-fledged river coursing its way to the dry plains below. To the passing motorist, these sudden and unpredictable floods are a nuisance, and the destruction they cause is often considerable; but to the permanent resident, they are a feature of a land that is beset with a vastly greater problem—not of too much water but of too little.

In a land of wells and windmills, where all usable water must be pumped from unseen reservoirs far

◀ Arid Arizona: a land of scorching deserts, occasional downpours, and irrigated farmlands. Rainfall originating in rugged uplands like the Superstition Mountains, viewed here between two stately cacti, pours downward and recharges the underground reservoirs. Almost all water for field and home comes from wells

Photo by Reginald Russell

▲ It is the suddenness of desert downpours that causes accidents like this. Dry riverbeds become raging torrents, bridges are washed out, and treacherous areas of quicksand develop. The waters not long before completely covered this car and were flowing at a rate of about 30 miles an hour

Photos by U. S. Geological Survey unless otherwise credited

beneath the ground, nothing is of greater concern than the quantity of accessible ground water. If the level of this water falls below the reach of the deepest wells, the only available source of supply is lost. Such a land is this great Valley of Santa Cruz, which drains an area approximately as large as New Hampshire. Its ground-water level is dropping—slowly, almost imperceptibly, but surely. And it will continue to drop, so long as it is depleted faster than it can replenish itself. Samuel F. Turner, ground-water expert in charge of investigations in this area by the Ground-Water Division of the Geological Survey, reports that in 1944 more than 200 major wells were under observation, in which some 806 measurements of water level were made. He states that during the six years this office has been in operation the level of water in subterranean storage basins has dropped from 10 to 20 feet in certain regions. In 1944 the pumpage of water in Arizona's Santa Cruz Valley alone was three and one-half times greater than the estimated safe annual yield and double that of 1940.

To a certain extent, this dropping of ground-water levels has been reported from other sections of the United States, including large areas of California, Ohio, Louisiana, and Georgia, and parts of Texas and Florida, especially in the vicinity of Miami and the Everglades. These conditions, while not regarded as immediately alarming, have nevertheless caused much concern. Turner states that the decline in his area is constant and that some remedy must be found to prevent overuse by both commercial and domestic exploiters who have continued to drill wells in increasing depths and numbers as the years go by. The principal usage involves huge quantities of water brought up from deep within the ground and employed in the artificial irrigation of thousands of acres of cultivated land where the farmers are almost entirely dependent upon

▼ Flash flood coming! Before many minutes have passed, various tributaries may add their supply to swell the tide and the entire landscape shown here may be under water. The rapidity of the run-off robs the land of much valuable well water

▲ WATERS RISE so quickly that highways are often overrun, forcing motorists to wait for the waters to recede. In the center of this flood a bus is stalled behind a passenger car

ground water for the success of their growing operations.

In the early days of European exploration, there was a great deal more water in the Santa Cruz Valley than there is today. When the Pioneer Missionary, Father Kino, commenced the establishment of religious institutions in this same "Rio de Santa Cruz" region in 1691, he stated that water lay on the surface of the ground in sufficient quantity to be entirely adequate for the Indian population, in striking contrast to the drought conditions of today. Where powder-dry desert now prevails, tall grasses, high enough to reach the head of a horseman, once flourished in rich profusion on the soil-covered bottom lands. Now there are wells more than 800 feet deep. The introduction of electric pumps and the resultant day and night pumping of water have helped to draw off the invisible supply at an unprecedented rate. Beaver, once reported abundant in certain streams, would now perish for lack of water. In fact, the disappearance of water from the surface of the land has actually changed the character of the valley as a whole. Where the river once flowed steadily, there now exists only a dry bed throughout the greater part of the year.

The story of the replenishment of water in subsurface as well as surface regions is, in effect, the basic story of life in the entire mountainous-desert area. Winter snows and summer cloudbursts are the backlog of any refilling of the ground-water reservoir, but by no means all of the precipitation reaches the underground storage chambers. Evaporation under the hot sun, transpiration through the leaves of plants, and other factors prevent a large percentage from ever percolating downward to raise the so-called water table below. Consequently, replacement cannot hope to keep pace with excessive usage, and the result is that the entire area may one day become a wind-driven, sandy desert similar, in many respects, to that of the Dust Bowl.

The comment, "thirsty desert," has frequently been made, apparently to indicate that the dry sands and gravels eagerly absorb each drop of moisture as it falls. Nothing, however, could be further from the truth in the Santa Cruz Valley. Quite to the contrary, the desert surface is seemingly impervious in many sections, though of course not in all. The author and a companion once laboriously dug a hole about the size of a ten-gallon pail in the floor of the desert near Tucson, using pickaxe and shovel. The hole was then filled to the brim with water, and we sat down to observe patiently how the "thirsty desert" drank its fill. To our surprise, it required three hours for the water to disappear, and one observer facetiously remarked that the blazing sun seemed to take more through evaporation than did the earth through absorption! Indeed, it seemed as if the level would never drop, whereas if the water had been poured on ground covered with humus, it would have disappeared very quickly.

So it is that much of the water deposited by heavy cloudbursts, unable easily to permeate the desert floor in this region, simply runs off in sudden and destructive flash floods. Turner has discovered that some streams build up clay or siltlike bottoms that are practically impervious to water; it is as though one had covered the land with a thin layer of cement. The surface material dries and cracks under the sun, and when the next flood comes roaring along, it rushes over the ground, with practically no water seeping through. Of course, a prolonged scouring by water may remove the silt and create a permeable surface once again.

When one considers that the water table is at least 50 feet beneath the surface and in some places as much as 300, one realizes how long it may take individual droplets of water to find their tortuous way through minute interstices in the hard surface to the concentrations of water far below. Often the journey is fraught with difficulties that would seem insurmountable, but as long as solid rock does not block the passage, the water that is not otherwise lost somehow contrives to find its way there, particularly through the sand and gravel beds of streams.

A popular misconception is that ground water lies in enormous underground lakes. This is rarely the case. In reality, concentrations of ground water are invisible "rivers," flowing in the same general direction as the slope of the ground and moving often imperceptibly. It has been stated that bodies of underground water may move as slowly as a foot a month or less, depending upon the porosity of the material through which they must pass. Deep and shallow wells alike reach down to tap the water stored in small spaces in rocks, gravels, and other formations. When one digs a well, in almost any area, underground water is seldom encountered directly. It infiltrates or seeps into the opening that has been made and is then pumped off. However, when the level of the water table eventually drops below the bottom of the well, it becomes necessary to excavate to a greater depth, and knowing how slow the process of replenishment is, one pauses to wonder what will eventually happen when the table drops too far in the years to come.

This is the question that is becoming increasingly serious every year in the Santa Cruz Valley. It is true that water is seldom appreciated while the wells are still full, but it is hoped that conservation steps may be taken before they go completely dry. A natural resource as essential as water should certainly be protected at all costs. The building of many small dams in tributary washes or gulches is by no means the solution to the problem of encouraging water to "stay put." While this might benefit

➤ Irrigation canal. Millions of gallons of water, pumped from far beneath the surface, are the "lifeblood" of farms and ranches in Arizona. Snow-capped mountains like those in the background replenish the wells that feed irrigation ditches like this one. If the water is pumped faster than it is replenished, dust-bowl conditions can blight the land

➤ In flood: a desert gulch normally dry. Many a farmer and rancher wishes that more of this water would sink through the well-nigh impervious ground, for all their wells depend upon it. Time-worn channels like this one are dangerous to cross because of quicksand

∨ Much of the water that does not flow off evaporates into the desert air, so impervious is the ground

▲ **HERE** the water from the Santa Cruz River flooded areas of agricultural land. When it evaporated, the silt it had deposited coated the ground with a hard surface that further impeded seepage to the underground reservoirs

certain upstream areas, it could easily deprive communities farther downstream of what little they had before.

The Ground-Water Division of the Geological Survey does its best to inform the public concerning the condition of the water supply, but warnings and up-to-date information only too often fall upon deaf ears. Turner keeps the newspapers supplied with information at their request and issues frequent bulletins. In one instance, he visited a region to hear a speaker discuss county water supply problems, only to find himself called upon. He discovered that the local paper had published an article that day minimizing the seriousness of the ground-water situation, and he did his best to present an adequate picture of the true conditions. The newspaper editor was present and, realizing that a falling water table was of far greater consequence to his community than he had thought, afterwards wrote an editorial retracting the statements of the previous day.

Desert flora, such as cacti and the palo verde and mesquite trees, can survive by storing away small quantities of transitory water near the surface. But many other plants in the region, such as tamarisk and cottonwood trees, are dependent upon the deeper ground water for survival and must tap it with their root systems. These roots often extend downward for many yards and are known to grow longer as the water level retreats. If the water table is lowered too far, however, many of these trees and other plants are unable to carry on. Various birds and animals, lacking the food and shelter of these plants, then also perish. Although many of the huge cottonwood trees that line watercourses or former watercourses in Santa Cruz Valley often appear to live without visible means of support when surface water is nonexistent, they are nevertheless dependent upon the unseen sources that lie far beneath the surface. This fact should be recognized by ranchers who frequently wonder why the trees die but fail to take into consideration deep wells near-by that are constantly being drained through pumping.

It is obvious that the geologic formation of subsurface material will govern, to a large extent, the amount of ground water to be found in a given area. If the spaces between the rocks are large, there will naturally be greater room for water. The underground storage basins, which receive the water that seeps through from above, vary from huge caverns of limestone to imperceptible spaces, actually so small that a microscope is needed to see them. In some regions the water can flow readily from one area to another, while in others underlying formations of solid rock produce isolated pockets of water. It is well known that sedimentary deposits, containing gravel and rounded or angular rocks of varying size, are particularly favorable for storage, because of the relative ease with which the water can percolate through them.

So concerned is our Federal Government with the entire story of underground water, regardless of its source, that the Department of the Interior, through the Ground-Water Division of the Geological Survey, maintains staffs of experts in 38 states and Hawaii. These overworked staffs are charged with many responsibilities, including, among other things, the estimation of available quantities of water, their sources, fluctuations, and directions of movement, and many other equally important projects, all of which are of inestimable value in the ultimate conservation of ground-water resources. Their work, particularly in determining the location and amount of the hidden supply, is appreciated by many of our states, which often contribute an amount of money equal to that supplied by the Federal Government to enable field stations to operate. Often the technicians issue statistics upon which is based corrective legislation to govern the use of water.

A typical field office of the Ground-Water Division is the one located in Tucson, Arizona, which is entrusted with obtaining information about the presence and availability of water in that climatically diversified region of desert and mountain. Here is situated the great Valley of Santa Cruz, where climatic conditions range from arid at an elevation of 1000 feet to humid at 9000 feet, and where the

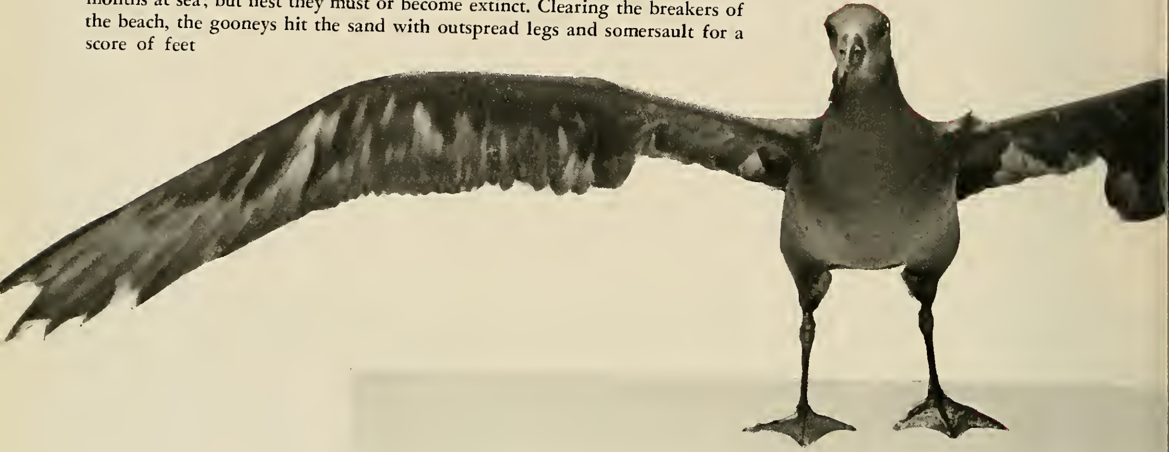
Continued on page 387

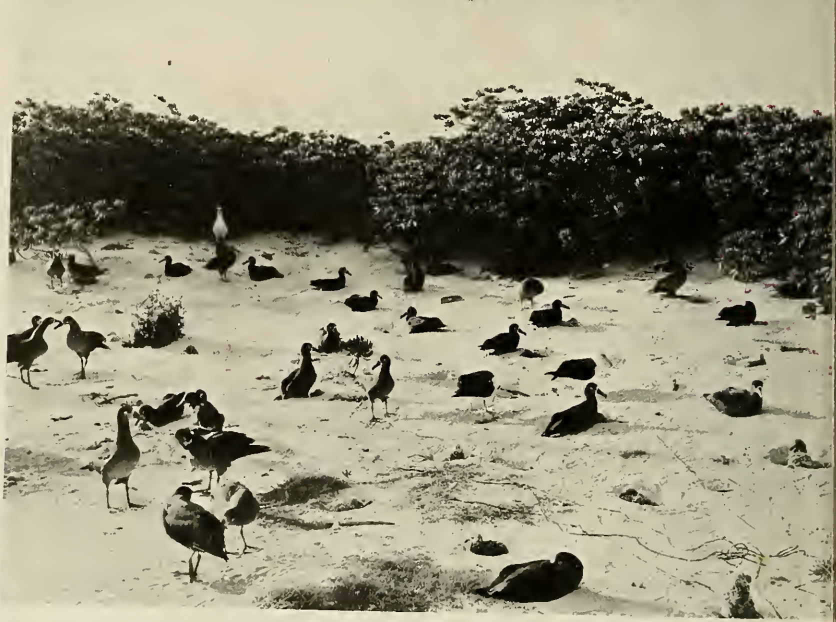
▲ SAND STORM blowing in from the desert. Lack of sufficient vegetation favors storms of this type, which benefit neither man nor beast and sometimes cause considerable damage

▼ STORM CLOUDS over Arizona's Tanque Verde Mountains. These summer storms, often torrential in character, provide the principle recharge for ground water supplies. It is for man to guard carefully the level of his wells, for historical records indicate that there was once much more water in the region

The BLACK

➤ MANY OF THESE TREMENDOUS BIRDS with 7-foot wing spread have not seen land for many weeks when they glide in to nest on islands northwest of Hawaii. Some have been as far north as the Aleutians, others have spent their time off the coast of Lower California, or within sight of Japan. Their legs, though strong in swimming, give the bird poor support in landing after their months at sea; but nest they must or become extinct. Clearing the breakers of the beach, the gooneys hit the sand with outspread legs and somersault for a score of feet



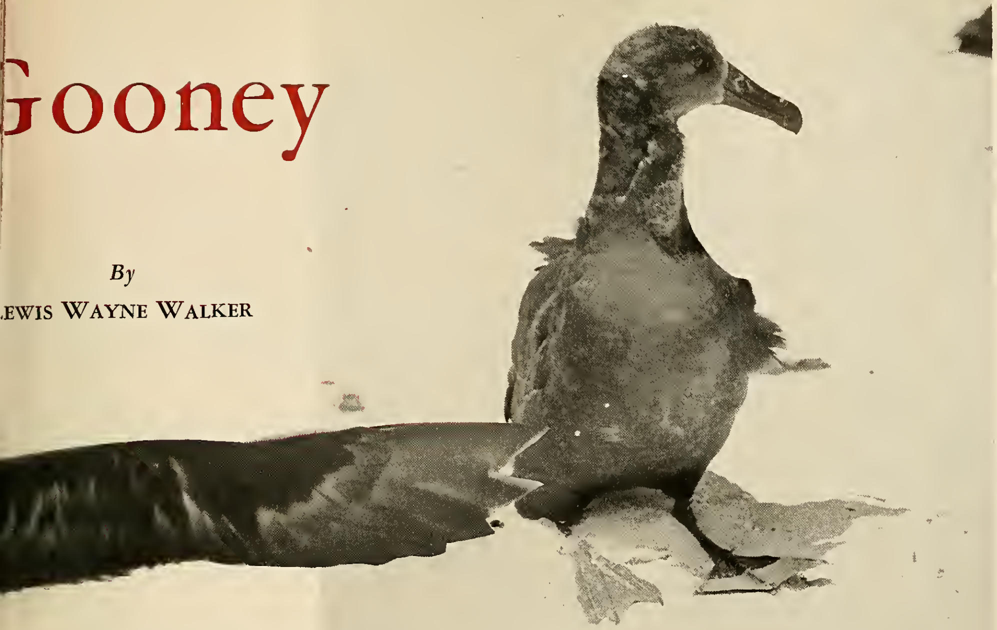


➤ A COLONY of black-footed gooneys, or albatross, with a few Laysans. In selecting a nesting site, one bird of a pair will carefully scoop out a hollow in the sand and, with actions that would put many a real estate agent to shame, attempt to convince its mate that this is the "spot of spots." The other bird may have found a location that is "just as good." Condescendingly each walks over and views the other's choice. Morning will find a five-inch egg in one of these holes, and this will be the final determining factor

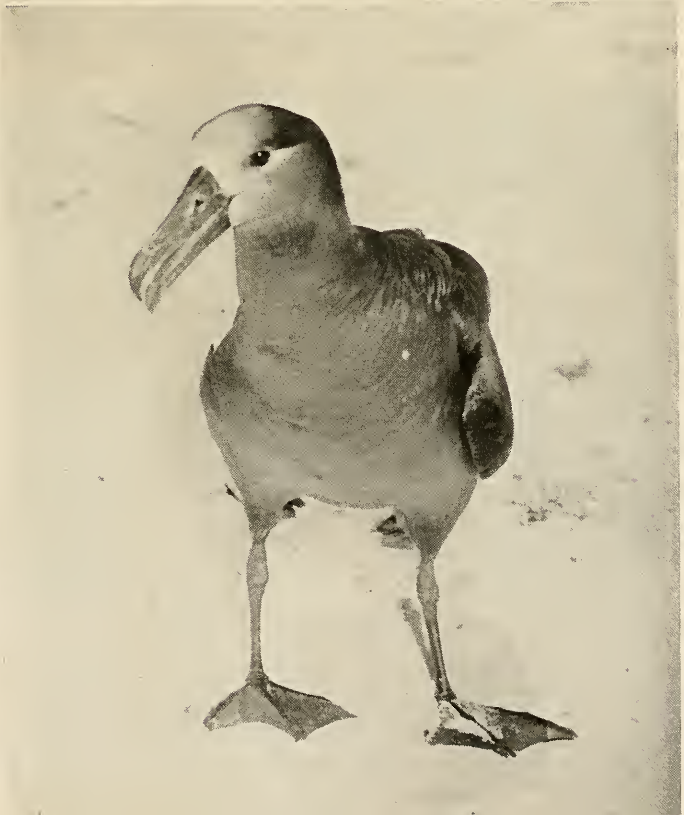
Gooney

By

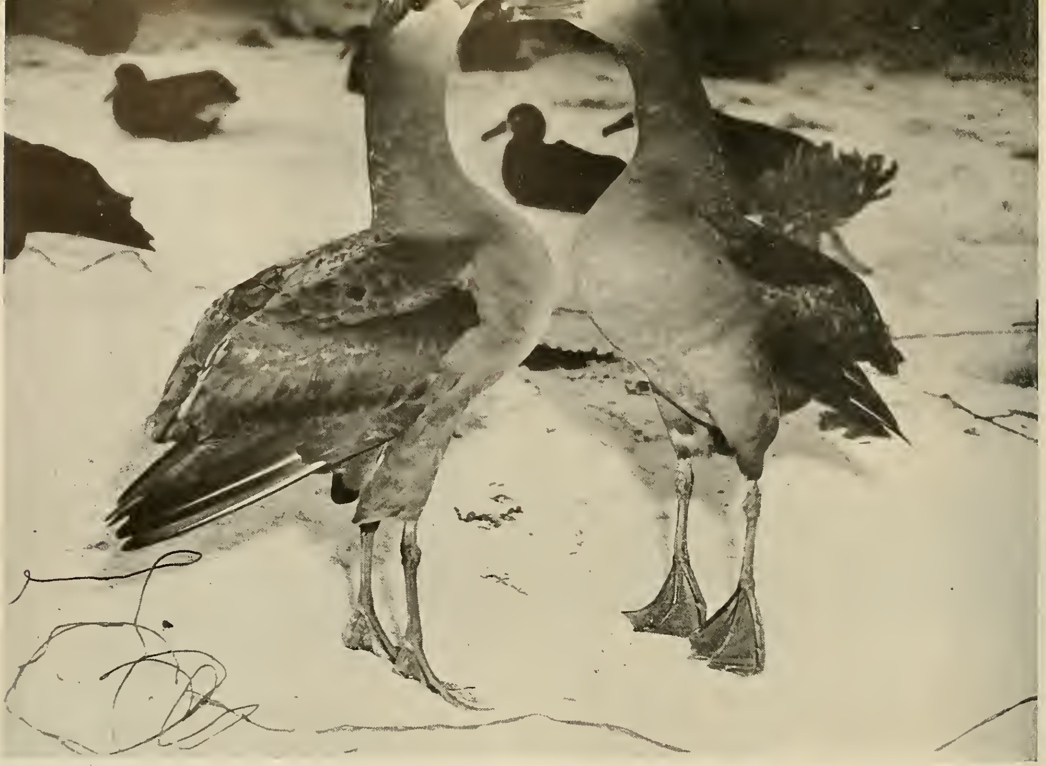
Lewis Wayne Walker



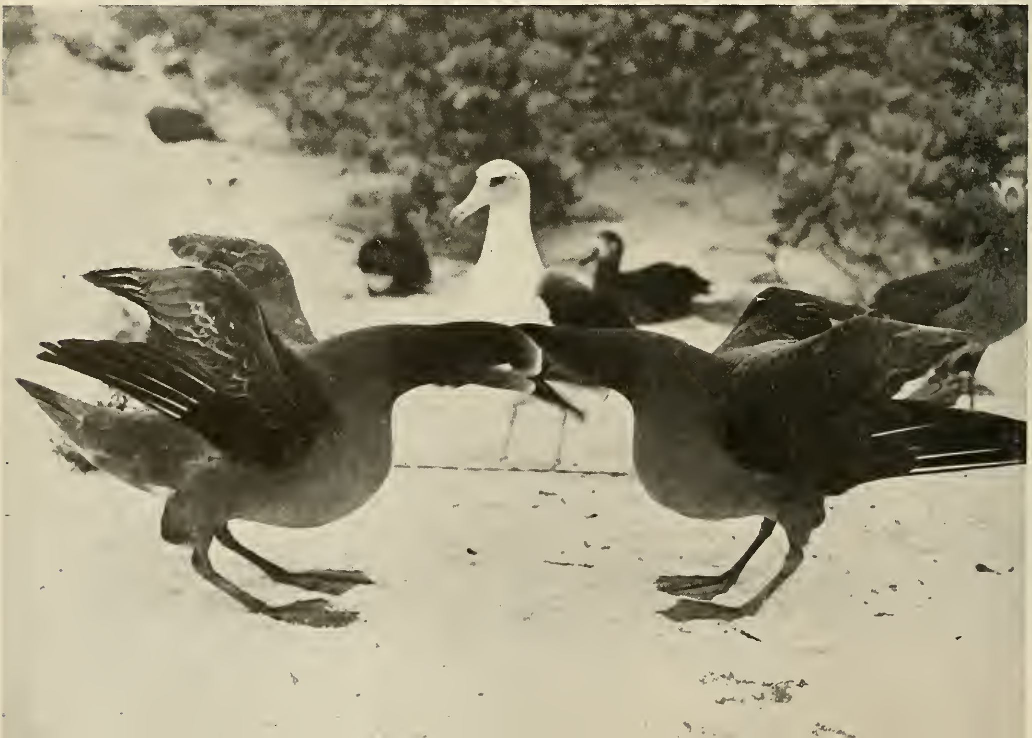
➤ A young black gooney which has never been to sea. Yet when it goes, it will return unerringly to the islands where it was born



➤ An adult gooney: the bird that has entertained thousands of our servicemen on remote islands of the Pacific. They remain on land for about nine months of the year, beginning in November



"SHALL WE DANCE?" Black gooneys, like the famed Laysan albatross, have an entertaining dance routine. Here two of the birds address each other with dignity. But since the black gooneys lack the pleasant disposition of their white cousins, a slight misstep on the part of either partner may convert formality into chaos, and viciously snapping bills will end the act, as shown below



MEET JOE GOONEY
CLOWN
OF THE ISLAND CIRCUIT

By EDWIN D. NEFF

IF you know a serviceman in the Pacific—afloat or ashore—it's a hundred-to-one he's been writing you about his new friends, the gooney birds.

Gooney birds were press-agented long ago by Samuel Taylor Coleridge in "The Rime of the Ancient Mariner," as the albatross. Today these wonderful birds are making amateur ornithologists out of half a million Americans who are seeing them for the first time. Most of these youths and their commanding officers had never given a half-hour's thought to any bird before.

When the gooney appears behind a ship to wait for food, seamen, petty officers, ensigns, and even four-stripers give quiet little lectures to newcomers to the Pacific, and on the nesting islands, even the mighty seabees hop down from their roaring bulldozers to rescue infant gooneys in their path. There is a tacit understanding on gooney-inhabited islands that anyone "unduly molesting" the birds has earned a stiff sock in the jaw—for gooneys have laid enough golden laughs to be worth their weight in comic strips. The name "gooney" itself comes from "gony," meaning a dunce or simpleton.

Nonchalant, poker-faced, and wholly lovable, gooney birds walk with a hay-foot, straw-foot waddle that is better than anything Charlie Chaplin ever did before a camera, and their attempts to land on a calm day are reminiscent of burlesque's immortal "sliding" Billie Watson at his best.

Ornithologists recognize nineteen species and subspecies of albatrosses and have found them throughout most of the oceans, except the North Atlantic. Yet, no matter what role has been assigned to these birds by science, it is G. I. Joe who has discovered that the gooney bird is one-third comic, one-third "straight man," and one-third human.

The gooney's talent for clowning comes into play the instant he lands. He is just not built for shore duty. His scrawny legs are set far aft and wide apart, while his weight, like a hefty dowager's, is forward. His feet are big and webbed, protruding like the shoes of a circus clown; and when he walks he bumps and bounces worse than a flat-wheeled ox-cart.

Yet when he stands still, or sits on the nest, the gooney is as handsome as a square-rigger, his big, snowy chest billowing like a mainsail in a 40-knot wind. He is of about the same general architecture as a goose, but his yellow beak is longer and it is tipped with a hooked point. His eyes are shiny black, and in the case of the Laysan albatross, the feathers beneath them are shaded a delicate gray. The stately Wandering albatross is believed to have a greater wingspread than any other bird—11½ feet—, but 6 or 7 feet is about the average for the Laysan albatross and the black-footed gooney. When you approach one of these birds, he will bow politely, then back away. Except for a few incidents some years ago, when Japanese feather hunters slaughtered the albatross on one of the Hawaiian nesting islands, the birds have been unmolested for thousands of years, and are nervous, rather than afraid, in the presence of people. Move a few feet away, and they forget you.

Despite their awkwardness ashore, the gooneys spend only a little better than three months a year at sea. There is evidence that they fly heroic distances; banded birds have been discovered 6000 miles away from their starting point. They depend upon the sea for both food and drink. When mating time arrives in late October or early November, the males return to the nesting islands following some little-understood instinct, and a few weeks later their girl-friends flutter in.

On the nesting islands, now occupied by servicemen, the returning gooneys are as welcome as a U.S.O. show. Uniforms gather on the beaches, and there is a laugh for every landing. The size of an albatross's wings doesn't permit them to move with the lightning flutter of a small bird's in landing. The gooney does best against a strong wind. When he tries to land in a calm, he comes in too fast, hits the beach with a sickening plop, and skids along the sand on his chest. Then he staggers to his feet, looks around as if to say, "Who pushed me," and waddles off self-consciously. No matter how many years of landings are allotted to a bird, he can never fully master the calm landing. When the wind is strong, he will float down as gracefully as a paratrooper, landing almost on his toes. But a dead calm is disastrous.

Take-offs too are a problem when there is no wind. Gooneys never perch on rooftops, trees, or telephone wires. Like airplanes, they need a fast take-off against the wind. On some of the gooney islands, Uncle Sam has built magnificent runways, which the gooney birds use freely. Yet even on a runway, the gooney's technique is nothing for a pilot to emulate. He holds his wings slightly aloft, umbrella-fashion, and when he starts to run, his webbed feet pound the runway like the brogans of a Keystone cop. He sprints up to about 20 miles per hour and takes off. Once in the air the burlesque ends, and the gooney becomes as graceful and elegant as a ballerina.

Long known but seldom seen until now, these curious birds are winning the affection of thousands of G.I.'s in the Pacific and are providing as much amusement as half a dozen comedy acts put together

One of his favorite maneuvers is to slip down an airstream to within a few feet of the earth, then bank suddenly, lowering one wing tip to a fraction of an inch from disaster. Somehow, they never miss. Any human pilot who tried it—and lived—would be grounded for life.

Pilots feel a natural friendliness for gooney birds. Seeing them for the first time, they stand around laughing and pointing like kids on a Sunday School picnic at the zoo. Usually the spectators are satisfied with a free show, and wander off after a few painful attempts to pet the birds or pick them up. But sometimes a departing airman will try to kidnap a gooney. The gooney's hooked beak is as swift and accurate as a striking snake. Struggling birds have been rescued literally from the cockpit by their friends—and it's just as well, for gooneys never have been known to survive captivity.

Besides their comic gait and fouled-up landings, the gooneys have a number of tricks that endear them to servicemen. Easily the most spectacular is their dance. Since both males and females look alike, it is impossible to tell whether this weird performance is a love dance or just a game. Probably the latter, since the dancing goes on after the mating period. The invitation to the dance is a gracious bow, combined with clacking of beaks. The bowing soon becomes frantic, involving the whole body, which rises and dips like the prow of a canoe. Suddenly one of the birds breaks off this rhythmic bobbing and ducks its bill beneath a quickly raised wing. From time to time the dancing birds snap their beaks toward the sky and give out a long, calflike "mooooooooo." *Vis-a-vis* again, they shake their heads with a fury that ought to addle their brains.

The whole ceremony is punctuated with shrieks and screams, alternated with the sharp, castanet sounds of the powerful beaks. This beak is about six inches long, solidly built and well-muscled. It can snap with the speed of a terrier's jaws and clamp down like a bulldog. At sea, the beak snares the food, which consists largely of squids; and it is a useful weapon at all times.

G. I. Joe discovers this when the gooneys are nesting. Both male and female alternate at this duty, sitting three- or four-day watches for nine weeks. Off the nest the bird is wary of human advances, but when he—or she—is covering an egg, the bird will not budge, except to rise, from time to time, to look down and under at the egg, and to "chirp" reassuringly to the infant within. Anyone trying to move a gooney from the nest is asking for a fight. The bird arches its neck like a coiling snake, its eyes bright and fearless. It knows the sensitive parts of the human anatomy, and will show only mild interest in a heavily-shod foot. But a bare hand, however tenderly advanced, brings a swift and painful jab. The hooked point always draws blood. But it cannot tear off a finger, as newcomers to the nesting islands are sometimes told.

Yet even on the nest some gooneys can be tamed. The nest is haphazardly built of sand scooped up a beakful at a time and distributed more or less evenly around the egg. Sometimes leaves, ribbons, or bits of trash are added. Often one of a pair of nesting birds will take pride in repairing the nest, while the other, doubtless the male, is archly indifferent. Most birds will accept human assistance, and a few are even grateful. On one island, a half-dozen birds built their nests on the leeward side of the Navy Post Office. Came a heavy rain, and the sand washed away, leaving the birds to shiver in little puddles of water. One of the mail clerks, touched by their plight, brought dry sand in a wheelbarrow and built magnificent new nests. The birds were plainly grateful and seldom snapped at their benefactor. They even seemed more temperate toward strangers.

On the other hand, one gooney, who established herself at the door of the officers' club, became deeply cynical toward men. Both junior and senior officers startled her at night with rollicking affection. Following a New Year's party, they forced her into a jeep, and on a sharp turn the outraged bird was thrown out, bumping her nose on the concrete. After that, the mere sight of braid would infuriate her—though she refused to move herself or nest.

Sometimes there is tragedy. Planes and trucks inevitably collide with some of the birds, and telephone wires are new to their experience. First aid is rarely of any use. Although the birds know a score of love calls and ecstatic shrillings for their dance, there seems to be no cry for pain. A bird with a shattered wing makes no protest. Like all wild things, it waits for death alone—silent and unafraid.

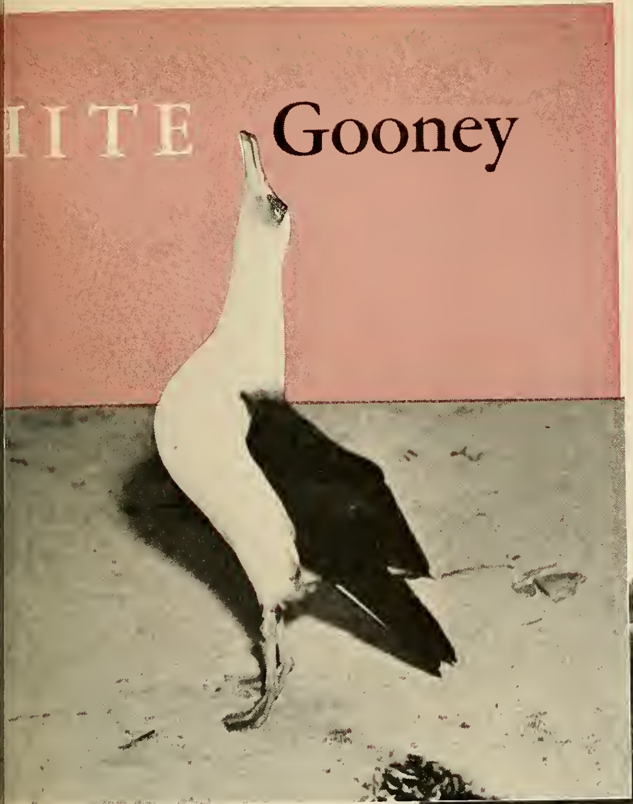
The

BEFORE the present Pacific war, the dance of the white gooney, or Laysan albatross, was known to the general public solely through motion pictures taken by a few explorers. Now, however, thousands of servicemen have seen the birds.

Many of these islands were not discovered until about the middle of the last century. Some early navigators were drawn to their shores by the abundance of bird life on the surrounding ocean. Others found the islands unintentionally at night when their ships crashed against treacherous reefs. For many years, Laysan was the only island of the chain stretching northwestward from the Hawaiians to be utilized commercially. This island had an accumulation of guano, many feet thick, and packing of this fertilizer was carried on until the early 1900's.

The bird life of the island was protected by the guano workers, and although the eggs were used for food, the birds fared well until their pro-

ITE Gooney

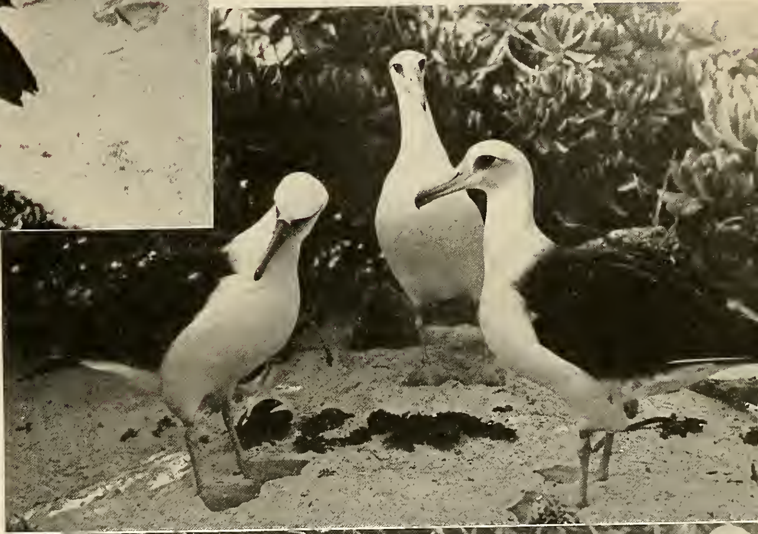


By Lewis Wayne Walker

The introduction of rabbits upset the balance of nature on Laysan Island—this together with the coming of feather poachers nearly exterminated the gooneys. Conservation steps taken in 1923 have enabled the birds to hold their own

◀ The dance of the white-footed gooney, or Laysan albatross. The elaborate routine seems to have no sexual significance. Sometimes three or four birds engage in it, and sometimes a gooney will start the dance if a person holds his arm in a position resembling the neck and head of a bird

▼ A sociable group, less held down with the responsibilities of parenthood than a few weeks before. *Below:* The gooney walk



tectors departed. Rabbits, left by the guano workers, then increased by proverbial leaps and bounds and rapidly depleted the island's limited vegetation. Sand, no longer held in place, shifted back and forth with the wind and covered eggs as rapidly as they were laid. As though to hasten the desolation, feather poachers landed and set up camp. With short clubs they killed thousands of trusting birds that had never known a land enemy.

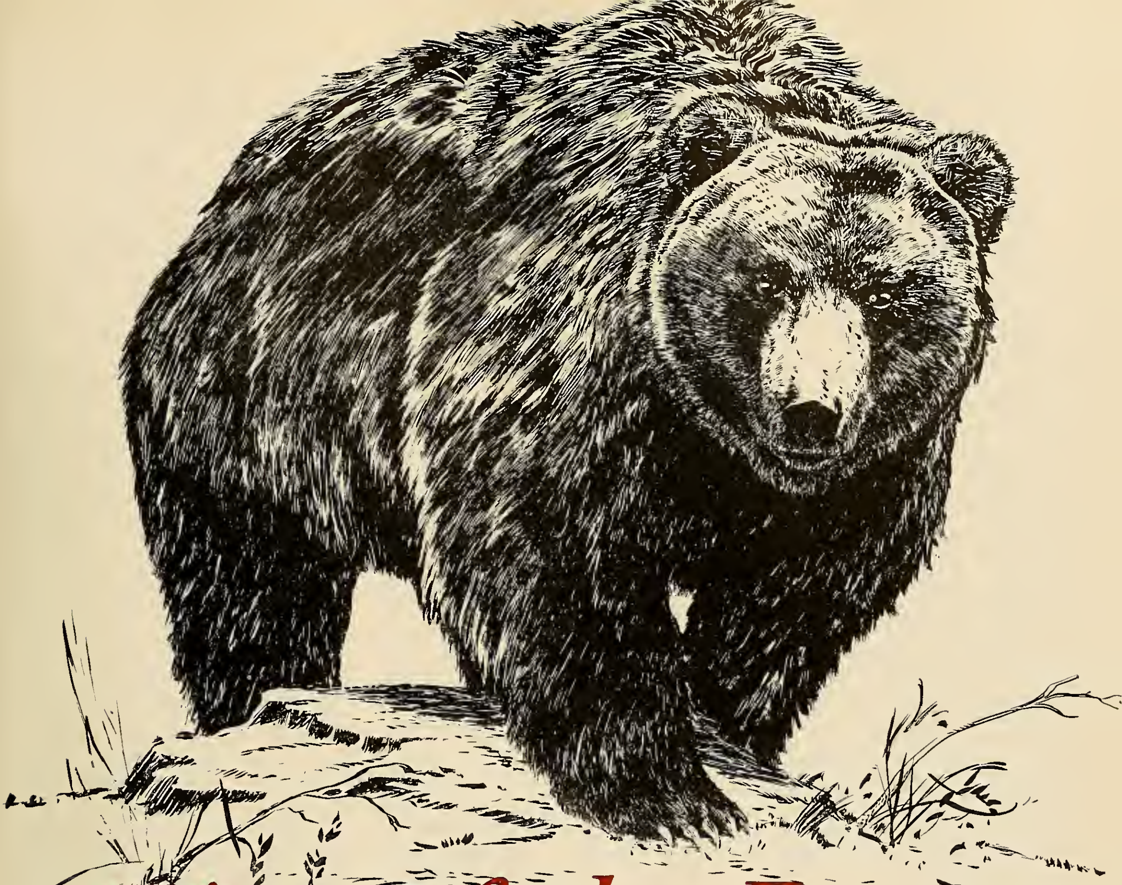
In 1923 a group of scientists landed and, to halt the deterioration, completely eradicated the rabbits, which had by then reached a point of starvation. Seeds of grasses were sown and cuttings of suitable sand-binding foliage were planted, to make the island once more a livable haven for its original bird owners.

Two years ago I flew over this dot in the broad Pacific in the company of the botanist of the 1923 expedition. Where once there had been the white glare of shifting, powdered coral, there now came up to us the green tinge of vegetation. The labor of 20 years ago had been productive. Birds by the thousand were skimming over the grove and gathering their acquatic food from the turquoise shallows surrounding the island.

Hundreds of miles farther on we glided down and were surrounded with birds. Some single birds were incubating eggs; others were shading newly hatched young in depressions in the sand. The gooneys were apparently holding their own, and with wise conservation they will continue to do so. I was glad to have a camera with me with which to take these photographs.

◀ THE AWKWARD AGE: one of the young birds shedding its down

▼ A LAYSAN albatross sheltering its chick



King of the Bears

By BEN EAST

IN more than twenty years of hunting wildlife with a camera, in the woodlands and along the waters of America from the Great Lakes to the Aleutian Islands, I have encountered a great many interesting bird and animal personalities. But of them all, the most outstanding is the giant brown bear of Alaska, king of his clan and overlord of the flesh-eating animals left on earth today.

The brownie is generally accepted as the world's biggest bear and biggest land carnivore. Whether he can actually claim that distinction is open to some debate, however. More than one arctic explorer believes that the great white bear of the ice fields outranks him in both weight and length.

Authentic weight records for either animal are not too common, considering how many have fallen to the guns of sportsmen, collectors, and travelers in the last century and a half.

Not many big bears are killed under circumstances that make accurate weighing possible. The top recorded weight for the brownie seems to be 1656 pounds (cited by Seton from Ward's *Records of Big Game*). The same authority lists a 1600-pound polar bear killed in Hudson Strait more than a hundred years ago as the largest of that species ever put on scales. Stefansson likewise accepts 1600 pounds as the maximum weight for a white bear, but adds the personal belief that it is probably the largest of all bears.

Many guides and experienced hunters in Alaska believe the brown bear actually grows as large as 1800 pounds. Whether that opinion has a reasonable foundation or is only wild-guesswork is not easy to say. By the same token, men who have taken really big polar bears insist that the animals would have gone to 1700 or 1800 pounds if weighed in one chunk before being bled. Whether they are right, again, is hard to decide.

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*BEN EAST is well known to the readers of NATURAL HISTORY Magazine through his articles on conservation and the North. In 1931 he directed and accompanied as photographer the first winter flight to Isle Royale in Lake Superior, now a National Park. He was the photographer on a trip made to James Bay and Hudson Bay in 1937 for the University of Michigan and the Cranbrook Institute of Science. In 1941, as photographer and collaborator of the U. S. Fish and Wildlife Service, he cruised through the Aleutians to make natural-color motion pictures of the Alaskan sea-otter. In the same year he filmed the complete story of the Pribilof Island fur seal herd. He is the Outdoor Editor of the Grand Rapids (Michigan) Press and has contributed to numerous popular magazines.—ED.

I can offer only this much firsthand evidence: Our party killed a white bear on Grey Goose Island at the north end of James Bay in 1937 that measured 10 feet, 6 inches from tip to tip and 52 inches in girth around the neck before skinning. We could only guess at his weight, but Jack Palmquist, skipper of the trading schooner "Venture" on which we traveled that summer, believed he was not lighter than 1700 pounds. Probably that estimate was high. All the same, the green pelt, with feet and skull skinned out and every ounce of fat scraped away by Cree Indian women, weighed 125 pounds on the scales at the Hudson's Bay Company's post at Fort George two days later.

It is interesting to compare the measurements of that bear with those given by Seton for the Alaskan brownie. He lists a bear taken on the Alaska Peninsula in 1918 by Robert H. Rockwell of the Brooklyn Museum as 10 feet, 6 inches long with neck girth of 41 inches skinned, and adds "This is very near a record in size." Obviously our polar bear was as big if not bigger.

Whether the king of the arctic ice or the king of the Alaskan rock slides reaches greater size is of no major importance. Both are magnificent bears, by a wide margin the greatest big-game animals the western hemisphere has to offer and ranking well up among the dangerous game of the world.

To me it seems that the Alaskan brownie has a trifle the more colorful personality of the two, but maybe that's only because I've had a little more to do with him and know him better. Likely the ice bear would on further acquaintance prove every bit as whimsical and unpredictable and hair-raising.

The white bear—Nanook to the Eskimos, and Wabesco to the Hudson Bay Crees—is a bear of the sea, the brown a bear of the land. And I must admit I have met the two of them only on land, where Wabesco was out of his element. Were I to know him in the arctic ice or along the open leads where ice and sea meet, it is likely I would revise my estimate of his character completely.

One of the most unforgettable summers I ever had was spent in the brown bear country on Kodiak and Afognak Islands and along the bleak and barren Alaska Peninsula, just before the war.

We didn't have much luck that June and July along the salmon streams of Afognak, or in the devil's-club and salmonberry thickets of Kodiak. We found plenty of bear signs; we followed bear trails along the creeks that were worn as deep and smooth as sheep paths, and we blundered into bear beds in the tall rye grass without knowing they were there. But luck and weather turned against us time after time, and we moved on to the Peninsula finally without making one good contact.

There we found more brownies in one day than I had expected to see in the entire summer. Our record was fifteen between noon and dusk, an even dozen of them within camera range.

The rock slides, the high walled canyons, and snow patches just below the permanent snow fields of a 6000-foot mountain out there on the Alaska Peninsula make up a desolate and almost lifeless landscape. Yet it is in that landscape, high on the windswept slopes where neither grass nor creeping shrubs are able to defy the endless cold and bitter storms, that the great king bear makes his home.

The brownie has magnificent, breath-taking scenery in his front yard. Brown hills streaked with snow drop away on all sides from his lofty retreat. Farther down, near the sea, he can look out over rolling green meadows laced with the silver threads of tiny, snow-fed creeks. Here and there belts of darker green mark alder thickets beside the larger streams. And in the farther distance lies the steel-gray sea. He is seldom out of sight of it. He is the ruler of a vast, high domain, remote and forbidding. He owns the roof of the world and in its windy canyons and on its cinder-paved plateaus man is a puny intruder, uneasy and out of place.

Of all the bears we met in that empty, giant land, I remember best five that we spotted all at the same time one afternoon, while we were following the rim of a rock slide that fell 500 feet, steeper than the pitch of an average roof, down into a sunless canyon where a wild creek of ice water from the snow fields brawled and roared.

I was with Frank Beals, an Alaskan game warden, and Jack Benson, a wildlife agent of the game commission from Kodiak. Beals and I were toting cameras. Benson had the rifle—and the ability to use it if the need arose.

We stopped at the rim of the slide to look out over the lower end of the canyon where it spilled into a meadow a couple of miles away. We could trace the silver line of the creek all the way to the place where it lost itself in the alders of the meadow. And along its banks, half a mile from us, we saw something move, something which at that distance didn't look much bigger than an overgrown brown marmot.

Benson laid his glasses on it and let out a low grunt of surprise. "Bears," he said sharply. "Four of 'em!"

I put the motion picture camera down and had a look with my own glasses. The brown object we had seen was a big sow, a rich cinnamon in color. She was following the creek upstream at a steady walk, apparently on the lookout for stray salmon. Tagging after her, romping on her heels, were three cubs. They looked almost black, but even at that distance I could make out the pale, cream-yellow collars that are the hallmark of the young brownie. We guessed their weight at 30 to 40 pounds apiece. We watched them for a couple of minutes. They were a lively trio if ever I saw one, full of mischief and devilment.

Beals took a step nearer the rim of the slide for a better look. He happened to glance straight down the slope and there, 500 feet below him, was the fifth bear. It was lying down on a little mossy bench almost at the lip of the canyon, and we assumed it to be a solitary boar. It was big and much darker than the distant female and we guessed its weight at better than 1000 pounds. We found no reason to revise the guess on closer acquaintance.

By that time Benson had the stalk all planned in his mind. "We'll go down to the drop-off of the canyon," he said. "That will bring us 40 or 50 feet above the creek. The wind is drawing upstream with the bears. That sow and her three cubs will work right under us if we're careful.

I'll put you where you can pitch pebbles down on her back."

I was dubious. "What about Old Lonesome down there?" I demanded.

"We'll have to dodge him," Benson admitted.

It seemed improbable to me that we could descend the rock slide without alarming all of the bears. The slope was steep enough to make the climb actually dangerous, and inevitably we would loosen a hundred small avalanches on the way down. But Benson and Beals discounted that. No noise we might make, they argued, would reach the bears above the roar of the stream in the canyon.

We started, hitching and sliding, and at each step boulders rolled loose under us and clattered down, jarring others into motion as they went. We could see them bounce over the lip of the canyon far below us in a steady, noisy stream.

We covered 400 feet in 15 or 20 minutes. It would have taken the better part of an hour to climb back up again. At that point Benson called a halt while he did enough scouting to relocate the bears. It wouldn't do, he remarked, to get between the sow and the boar and thus have a brownie on either side of us in such a place. One of the first rules of brown bear hunting, especially when you're carrying a movie camera and looking for no trouble, is not to surprise the bear. The very first is never to let the bear surprise you.

Benson edged up to the top of a low ridge that shut off our view of the creek. He looked over and cringed back all in one motion. It was plain he had made contact at close range. Beals and I clambered across to him, and when I came into the clear on the crest of the ridge I was standing less than 100 feet from the biggest bear I saw that summer.

He had left his bed down by the canyon and started to feed up the steep mountainside, following a shallow, mossy ravine. He had his back turned to us but there was something surly and evil-tempered in the way he stood and in his lumbering, deliberate movements.

Benson and Beals went down flat on their faces to make sure the way was clear for the camera. I braced the tripod among the rocks and spun the lens into focus. The initial whine of the shutter reached the bear and whipped him around. There was nothing clumsy in the way he moved now.

He saw one man and only one, crouched on the ridge 30 yards from him, and decided instantly he didn't have to tolerate trespass of that kind. He stood for three or four seconds, huge head swinging, jaw sagging sullenly, snarling deep in his chest. Then Benson decided the bluff had gone far enough. He got swiftly to his feet beside the camera. Beals followed him and suddenly there were three men where there had been but one. It was too much for the bear. He lost his nerve, pivoted away, and put space behind him as if he knew all about the menace of the .30-06 that was backing the camera.

That left us free to look for the sow and her three cubs. It didn't take long to locate them. We crossed the ravine and started down the last hundred feet of slide, Benson leading. He stiffened suddenly and held up a hand in mute warning. I came up beside him, knowing the bears were dangerously near, but for the life of me I could see nothing of them. I searched the slope on both sides and as much of the canyon as I could see. The mountain was empty of bears. Then Benson pointed straight down the slide below us. What I saw was hard to believe.

The she-bear was sitting on her haunches on a mossy hummock just below, with her back to us. She was so incredibly close I had completely overlooked her in my survey of the landscape. I could have flipped my hat down on her from where I stood, or so it seemed. She had climbed up from the creek and selected this tiny bench on the mountainside for a special purpose. She was lolling there in complete comfort, suckling the three cubs.

I moved as soft-footed as a cat while I set and leveled the movie camera. When it was focused and ready I glanced at the scale on the 6-inch lens. The bears were exactly 25 yards away!

Out of the tail of my eye I saw Benson slip off the safety on the rifle. He was standing with his feet braced wide apart, easy and cool, but I knew he was expecting trouble. Twenty-five yards is too close to come to a female brownie with cubs.

I had the bear's broad, golden-brown back centered in the view finder and was feeling for the shutter with a forefinger when the trouble started. Obviously there was not room at the supper table for the three youngsters at one time. The one who was shut out was restless. He came scrambling suddenly around his mother, hunting mischief. He heard some small noise above him, looked up, and saw the three of us looming there about ten good bear jumps away.

I do not know to this day whether he gave the alarm vocally or by action, but he certainly gave it. The sow lumbered to her feet, staring up at us and covering the cubs with her huge body like an angry old hen. The seconds lagged on while she snarled and raged, and I waited for her to start and for Benson's rifle to smash out its flat report. I was certain there was no way to miss trouble now.

But I was wrong. It was the cubs that saved the day, whether on their own or under orders we could not tell. They broke suddenly out from the shelter of the she-bear and scampered off across the slide at top speed, with rocks as big as themselves rolling and clattering under them as they ran. The female threw one last rasping snarl up at us, and then she turned and galloped after them. She pushed them hard but stayed between them and us; and every few yards, until they dropped down into the canyon and out of sight, she would wheel about and warn us back with a full-throated roar of anger.

It was an hour later, shortly before dusk, that we saw the last of that brownie family. The old bear had led the cubs through the canyon and up the mountain on the opposite side. We spotted them a mile or more away, high on the snow field above us. The sow was leading now, and the youngsters were climbing slowly and reluctantly. We watched through the glasses. She walked ahead of them a few yards up the steep slope, turned, and waited patiently until they overtook her. Then she went on once more. Gray cloud masses lay on the mountain, and two or three times the bear family went out of sight for minutes in a patch of cloud. When we saw them last they were almost at the crest, plodding wearily up. All the mischief and play was gone out of them now.

In some remote valley over the sky line late that evening, we hoped, she gave those tired little imps a chance to finish the supper we had interrupted back there on the rock slide.

Australia's Living Legend of the "Lizard Man"

The ageless stories of the aborigines continue to exist in the strange and spectacular grandeur of the Australian desert—a curious mixture of fantasy and fact that preserves a fabulous past and keeps alive the customs and traditions by which these people live.

By CHARLES P. MOUNTFORD

All photographs by the author

All races have stories of their creation and that of the country in which they live. They are as varied as the people themselves and indicate, especially among the simpler cultures, their conception of the universe and their relationship to it.

Among sophisticated folk, like ourselves, such legends, unless linked with religious beliefs, have long since degenerated into old wives' tales or fairy stories that are still partly believed by the peasant folk. Many a native of Ireland has no doubt of the existence of the kindly little leprechaun with his pot of gold, or the banshee that wails at night over the peat bogs. And the graveyard at midnight still holds its terrors, even in this country.

The myths of ancient Greece, which were transmitted orally for centuries before Homer immortalized them in the magnificent literature of his country, were an attempt by those people to explain the topography and the natural phenomena about them. In their time, these stories formed the basis of the beliefs of the Greeks, but those days have gone forever.

Among the Australian aborigines, however, legendary stories are living in all their fullness. They are not fairy tales designed to amuse but are expressions of vital beliefs that not only explain the origin of the natural features of the countryside but also lay down the laws of good living that one and all must follow.

The aboriginal legends explain that before life came, the world was a huge level plain, that extended away to the horizon as far as the eye could see, its surface unbroken by a hill, watercourse, or even a tree.

At some unspecified time, corresponding to our creation period, giant semi-human creatures rose out of the ground and started to wander over the countryside. They appear to have resembled various animals and birds although they thought and acted like human beings. They met, fraternized, and quarreled, and even in their travels performed the same humdrum tasks as the aborigines of the present day. But whatever they did, there is always some natural feature that today marks the place. Thus, a water hole was once the spot where a kangaroo-man camped; a concave boulder near by, the dish left behind by a woman; and a curious outcrop of rock, her body as she looked out over the plain. Every hill, every watercourse, every unusual tree, and even the large star clusters, are visible evidence, to the aborigines, of the exploits and actions of those giants of the long-distant past.

One legend that attracted me was the story of a lizard-man, Nintaka (now a large reptile that lives in the Central Australian deserts), who, while he was the guest of some smaller lizards, the Ninjuri, stole from them a much-valued grinding stone.

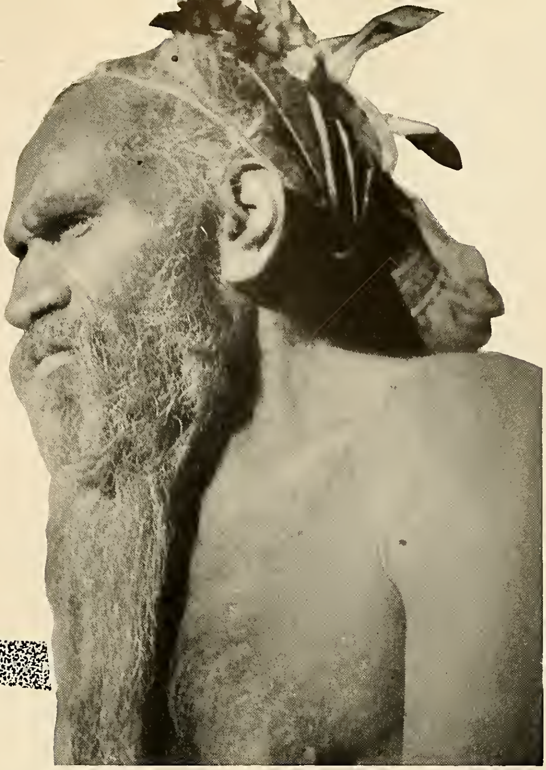
Away back in "dreaming" (creation) times, so old man Tjalarina explained, Nintaka the lizard-man paid a visit to the Ninjuri. According to the rules of that tribe, Nintaka was not allowed to live in the main camp. Every day food was brought to him: meat that had been caught by the men, and grass seed cake, gathered and ground by the women.

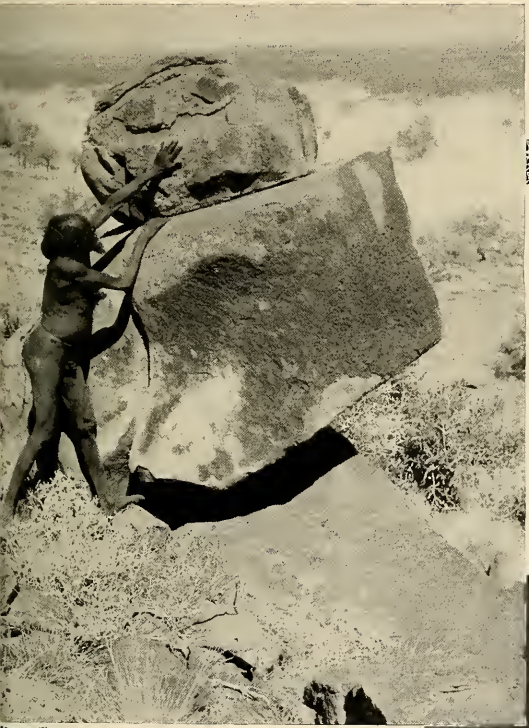
Nintaka noticed that the flour from which the grass seed cakes were made was not coarse like that in his own country, and much more palatable. When he made inquiries, he learned that the tribe owned an especially fine-grained stone which the women used to make the grass seed flour.

When Nintaka thought of the labor of his own women and the poor results they obtained with their rough grinding stones, he decided to steal the one belonging to his hosts and take it back home so that both he and everyone else would have cakes as good as those he was now eating.

And so, one morning, he pretended that he could not go hunting because a splinter of wood in his foot had made him lame. His hosts expressed their regrets, gave him some food, and went on their way. As soon as the

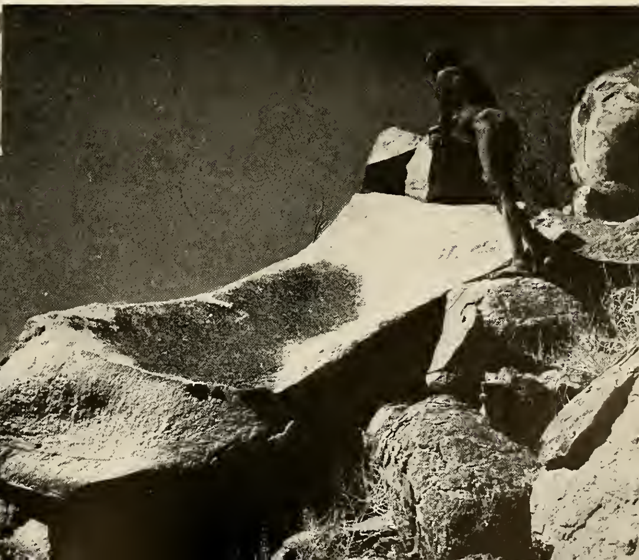
➤ TJALARINA, part-owner of the land on which a famous mythical character, Nintaka the Lizard-man, died. This native was the author's chief informant regarding the legend of the Lizard-man

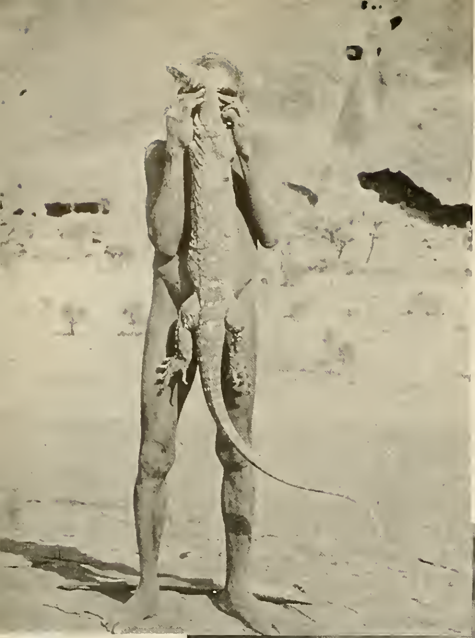




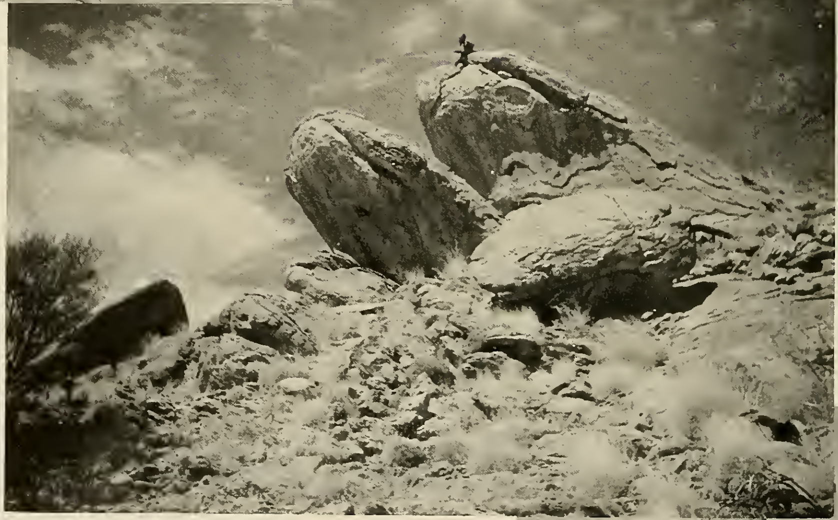
▼ AUSTRALIAN NATIVES have a legendary explanation for almost every natural feature of their wilderness homeland. This hollowed boulder on a hillside is the carrying dish of Malili, a woman of creation times who camped too near a sacred cave and was chased by the owners. In her flight she dropped the dish

▲ MALILI WAS KILLED as she looked out over the plain. This is her body, now a block of stone. The upper boulder is her head, the next her trunk, and the lower one her legs

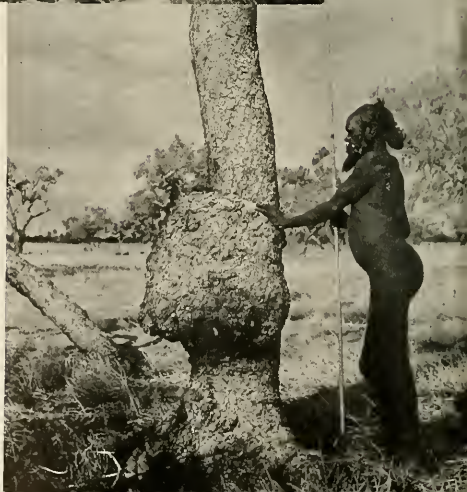




◀ The Parentie Lizard embodies the leading character in the legend of Nintaka, which is illustrated by the following pictures. The reptile is somewhat feared because its razor-sharp claws are capable of inflicting deep and dangerous wounds. But the flesh is good to eat, and one Parentie provided the small party of whites with enough meat for at least two days



▲ Having stolen a grinding stone from some smaller neighbors, the Lizard-man fled and halted here, at Wankarinya in the Mann Range of Central Australia, to see if his enemies were following. The left-hand rock is the stolen grinding stone, and the egg-shaped one at the base is the head ring on which the stone was carried



➤ The bloodwood tree with a stomach-ache: a landmark at Tjitabidi in the Mann Range, Central Australia. This tree grew at the spot where Nintaka, the lizard, ate so many mistletoe berries that he sufferd severe pains in his stomach women had left, Nintaka went to their camp, picked up the grinding stone and made off, hiding his tracks as best he could.

The tribe, naturally angry both over the loss of their much-valued stone and the breach of good manners, set off in pursuit of the thief. Many and varied were the adventures of Nintaka, the lizard, as he dodged his pursuers. Finally, after a journey of over 400 miles, he lost all sight of them and started to relax his vigilance. On the eastern end of the Mann Range of Central Australia, he climbed to the top of a hill so that he could look out over the plain and make sure that his enemies were not following.

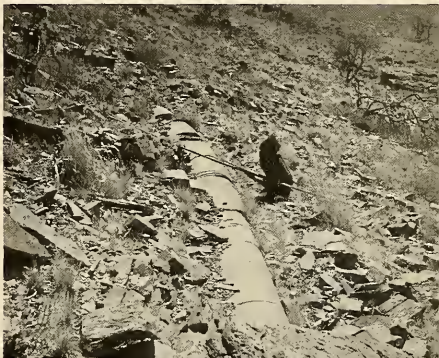
Today, there is a spectacular outcrop of rocks at this place. The upper one on which the native is sitting is the lizard, with his head raised, looking for his pursuers. The one immediately below is the stolen grinding stone; and the egg-shaped boulder is the head ring on which the stone is carried.

As no one was in sight, the lizard, Nintaka, meandered along the range trying out his ill-gotten treasure. At one place, he ground so much grass seed that it is now transformed into cliffs many feet in height. At another, he ate so many mistletoe berries that he developed violent pains in his stomach. Today, a bloodwood tree grows in this place with a large bole at the base, representing the stomachache of the lizard Nintaka of so long ago.

But the end of Nintaka was the end of all evil-doers, both in story and legend. His enemies, who, unbeknown to the lizard, had taken another track, killed him while he was asleep in his camp on the hillside.

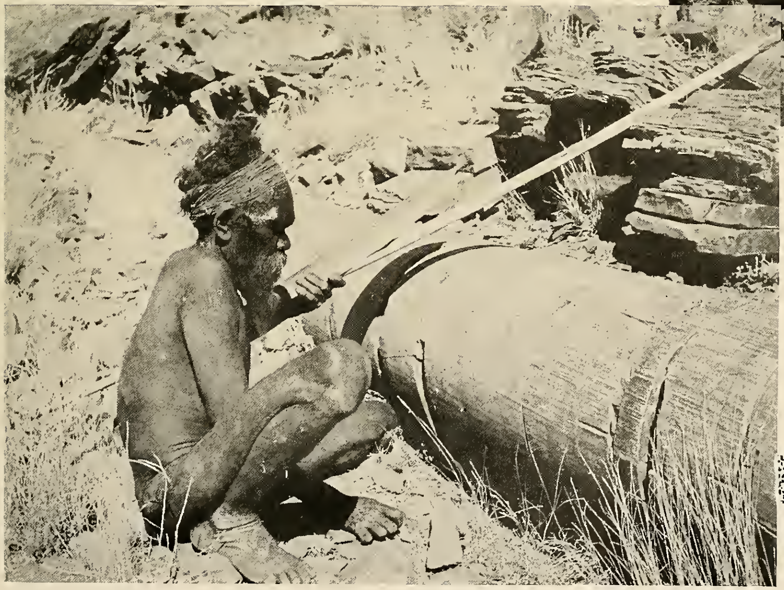
The body of the thieving Nintaka is now a long column of stone lying on the hillside; the stolen grinding stone, broken in many pieces, a pile of boulders lying at the foot of the hill; and the irate pursuers, the Ninjuri, dwarf desert trees growing near by.

This legend is only one of many that are all explained in the surrounding topography: the women of the Pleiades, who are always trying to escape from the unwelcome attention of the men of Orion; the giant, highly-colored serpent that lives in the water holes; and how the little lizards and birds got their markings.



➤ The dead body of Nintaka, the lizard. The long column of rock, a geological curiosity, represents the slain lizard. The boulders at the foot of the hill are the stolen grinding stone (broken in many pieces by the irate owners), and the dwarf desert trees, the avenging enemies of Nintaka

▾ A close-up view of Nintaka's body. Notice that the aborigine does not even allow his spear to touch the "dead body." The natives believe that to touch the stone would cause the spirit of the dead lizard to emerge and make them ill



MAKE YOU
TELL

DO your friends ask to see your most recent photographs? Not if you have to rummage through a secretary drawer full of prints, sort them, and then sit down to explain each one in boring detail, citing all of the incidents that each particular shot brings to your mind. But they will beg to see those same prints, if you are able to hand them a slim, little booklet that tells a complete story in words and pictures about your vacation, your children's adventures at the shore, the set of tree pictures you have just begun, or how your victory garden grew.

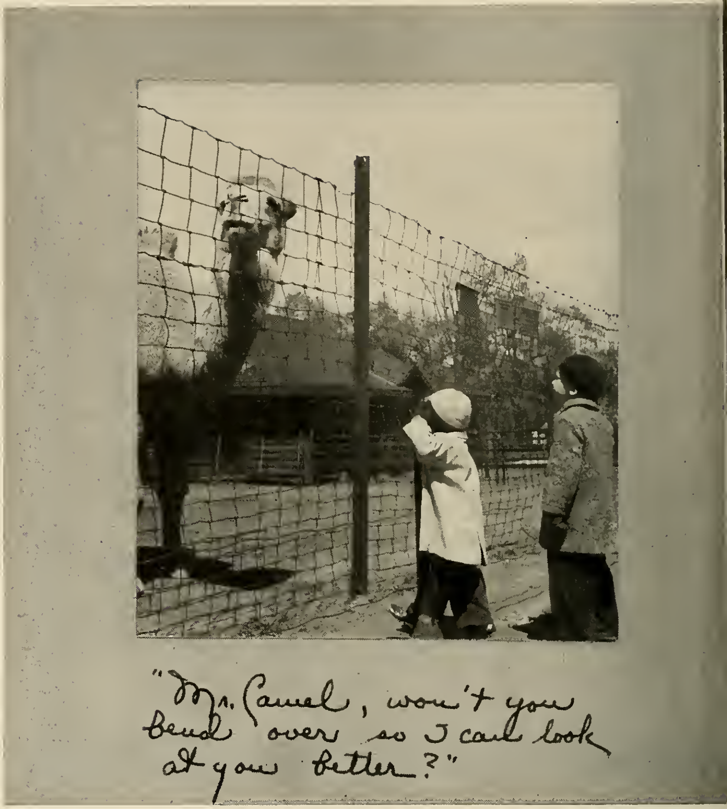
Then they can sit by themselves in comfort and set their own pace for musing over each picture and reading the running commentary accompanying it. After the booklet has been absorbed from cover to cover, your friends are quite apt to comment, "Say, this is wonderful! Do you have any more?"

We always feel superior when we know that our pictures have made a hit. The way to ensure that feeling is to spend a few evenings creating a small album for each set of prints. The necessary materials are neither numerous nor costly—just some "cover stock" paper, a jar of cement, the prints, and a sprinkling of imagination. These story albums do not have to be pretentious. They have charm even when ten or twelve pages are used in a booklet. In the beginning we should strive for simplicity, a single print on each page. To enliven the pictures, we add a few concise comments that complete the story. After we have made a few booklets, we see our one-time messy batch of prints materializing into coherent groupings.

The first step is to dump out onto the dining room table or the living room floor all the prints that are to be sorted. Boxes will help to keep the different groups separate. When there is doubt as to where a particular print belongs, put it in the broader category—a seagull picture made while vacationing on Cape Cod should go into the bird box unless it actually added something to the story about the Cape. When the preliminary sorting is finished, pick out a box of prints that you know to be fairly complete. This will become your initial project in story-album making.

The next step is to clear away everything except the all-important collection of prints. Lay these out on the table and check the negatives to be certain that no pertinent ones were unprinted. If the group is complete, arrange them so that you have a closely knit, coherent unit. This does not necessarily mean that they should be kept in chronological order. When you can compose an interesting running commentary about the pictures in a particular arrangement, number the prints accordingly.

As a working example, we might take the snapshots that were made during the children's visit at the zoo. Several exposures may have been made of the same subject in the attempt to obtain a "well-posed" picture. If, after the prints are arranged on the table, we find two similar camel pictures, the tendency may be to select the better print and discard the other. But wait; can't we use both prints? By placing them on facing pages and adding a bit of conversation, we would



"Mr. Camel, won't you bend over so I can look at you better?"

add to the interest of the story: "Mr. Camel, won't you bend over so I can look at you better?" and "My, what a big fuzzy nose you have!" Start the booklet on a note like this, and you will have "reader interest" immediately. Scatter the single pictures between the sets and retain that interest. If the story ends on a high note like the pony ride, your friends will want more (and so will the children).

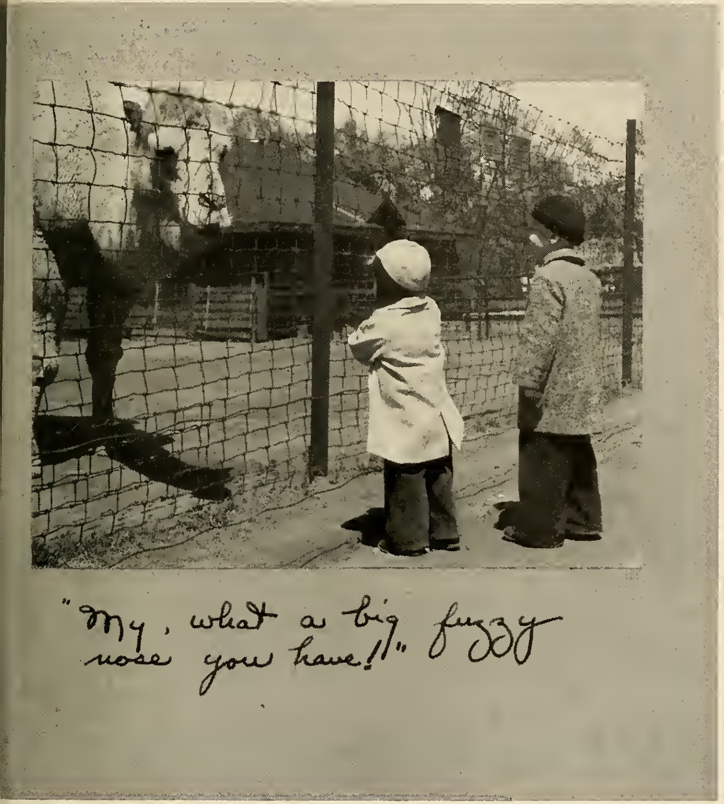
Now we are ready to consider the construction of the booklet. The paper can be purchased from a paper supply house, art supply store, or from a large stationer. The "cover stock," which is a heavy weight paper, may be procured with either a smooth or a dull surface. It is often used to cover mimeographed or printed reports. Or you might buy some of the paper used for pastel chalks, which is obtainable in many soft colors. This paper can be used for the entire booklet, or, if you prefer, use a lighter paper for the inside pages. Cut sheets of paper double the size of the page dimension and fold, producing four working pages. If possible, choose a size that will do for all the books, so that they may be stored neatly in the bookcase.

Place the prints in the proper sequence on the pages which have been arranged in book form, but not bound. If a pair of photographs that should face each other on a spread are separated, then the prints should be re-juggled. If the picture progression is continuous, as for a tree series, you might put all the pines or maples together; or in the case of a seashore series, you might start at high tide showing the plants and animals to be found along with the flotsam, and then work down to low tide and its denizens. When the final page location has been decided for each print note the print numbers on the pages and mark the corner locations for mounting. Leave plenty of room at the bottom of the page

NAPSHOTS
TORY

By THANE L. BIERWERT

Acting Chief, Division of Photography,
American Museum of Natural History


"My, what a big fuzzy nose you have!"

for the text of the story. We are now ready to mount the prints.

Open up the booklet and spread out the pages with their respective prints. Of course, dry mounting tissue, applied with a hot iron, is the best material for mounting the prints, but most of us will be happy with synthetic rubber cement, which can be procured at most art stores. Small prints need only a thin smear of adhesive along the edges, because no great strain will be exerted when the booklet is handled. Mount the prints on one side of an open sheet at a time. Place the double spread under pressure to keep the prints as flat as possible. In the same rotation, mount prints on the reverse side, weight them down, and let them dry.

When the last picture is in place and the booklet made up, you may be surprised at how good the book looks. At this point we are ready for binding. One method is to staple the pages into the cover. Most desk staplers will not span the distance to the center of the booklet, so open the book to the middle pages and face it down on an old magazine. Square up the edges of the pages and with a pushpin make holes along the fold half an inch apart about one and a half inches from the top and bottom edges. Insert the staples and bend over the ends on the inside center fold. Another satisfactory method for "binding" is the use of rings. This makes the book lie flat when open and avoids the curving of the pages, which sometimes makes the prints come loose. After we have made several story albums we will find that cords or ribbons as fasteners would make too many loose ends and are too fancy. Our creations would look more like dance programs than booklets.

The finishing touches are now in order. On the cover we write our title: "Gleanings Between the Tides," "Trees Throughout the Year," or "Why We Go to the Zoo." Under the pictures, write your comments. You are forewarned that white ink is unsatisfactory because it is not opaque enough to remain legible and never flows uniformly from a pen. Ordinary inks are preferable. If you do not trust your printing or handwriting for legibility, you may type the commentary on thin sheets of paper that will blend harmoniously with the pages of the booklet. These can be cut apart and pasted under the prints to which they apply. Inject a bit of humor and make your style conversational. Everything should be terse; leave something to your friends' imagination. An obvious statement is usually more effective than a lengthy explanation. The empty, upturned hand of a wee youngster who has just fed an animal at the "Children's Zoo" requires only, "Aw-gone!" And under the pony ride print we write, "Let's do it again."

There are many ways to enjoy this story-album hobby besides showing them to your friends. You can use them as Christmas or birthday presents for those who have more than a casual interest in the many subjects dealt with in this manner. As you gain experience in making the booklets, you can mix enlargements and contact prints on the same pages. Study the pages of well laid-out magazines and notice how balance and composition are achieved. Before long, you will be planning the story-albums before you take your photographs. The moment that you do that, the bug has really got you.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

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THE WATERS BENEATH

Continued from page 369

amount of rainfall varies almost in accordance with the altitude, from 8 to 30 inches. Temperatures range from 110 degrees Fahrenheit in summer on the lowlands to below zero in the mountains in winter.

The measurement of floods in connection with these studies sometimes becomes a hazardous undertaking involving the risk of life and limb. Several years ago, one of the Arizona Department's staff members, while engaged in determining the velocity and amount of water flowing in one of the suddenly created rivers, was forced up against the understructure of a bridge. As the water rose higher and higher, he was in imminent danger of being drowned. Fortunately, at the last moment, an associate, aware of his disappearance, suddenly saw his plight and effected a speedy rescue.

On another occasion, an investigater observing stream action found it necessary to wade across a rapidly rising watercourse. It was a very warm day and the location was far from civilization, so the perspiring man removed practically all of his garments, both as a relief from the temperature and as a precaution in the event that unexpected currents might sweep him downstream and force him to swim. No sooner had he reached the opposite bank than the flood waters rose so high that any thought of recrossing was out of the question. Consequently, he had to remain, without clothing, marooned overnight in the inhospitable, cactus-filled desert, anxiously waiting for the turbulent flow to recede and hoping that he would not step on a wandering rattlesnake.

Perhaps the most dangerous condition encountered while measuring stream flow is quicksand. One stream wader, bent on determining mid-channel depths, found himself suddenly engulfed in the treacherous stuff. Rapid thinking, plus the possession of a rope and the ability to throw it accurately, enabled him to toss a life line around a convenient mesquite stump and extricate himself from what might easily have been his last wading exploit.

Other adventures experienced by staff members, especially in the work associated with well production measurement, have ranged from narrow escapes from the bites of rattlesnakes, scorpions, tarantulas, and dogs to encounters with shotgun-bearing women and six-shooter sheriffs who disputed their right to be near isolated wells. To the survey crews, however, it's all in the day's work.

Many ranchers and farmers co-operate with ground-water investigators by supplying records of the amount of water pumped and the types of usage. They also report any unusual conditions affecting the water supply in their region. In the desert areas of Arizona, where few agricultural pursuits of any sort could exist at present without the use of water pumped for irrigation, land owners and operators naturally exhibit a keen interest in obtaining adequate supplies. Field office members answer many questions propounded by water users, and assist growers, wherever possible, to operate their lands successfully. Frequent requests are made by the state and by communities to find water in different areas, and this work occupies a great deal of time.

Methods employed to locate available ground water are far in advance of the use of the old-time "divining rod," which supposedly dipped earthward to indicate the presence of water, and the "doodlebug" of similar mystical propensities, familiar to many farmers and others for centuries. These superstitions have long since been blasted, yet even today and by no means in the backwoods alone, water diviners still practice their art for the benefit of the credulous. Present-day methods of discovering water, however, are based upon the practical application of scientific principles and the use of accurate devices, developed over a long period of years.

In addition to the expensive and time-consuming process of drilling test wells, the modern scientist has other systems at his command. Certain of these are somewhat complicated but efficient and rapid. One method involves the passage of electric currents into the earth's structure. These spread down and out in widening circles, after the fashion of ripples caused by the fall of a pebble on the surface of a quiet pond. The results are indicated on centrally located dials that are the focus points for wires attached to metal rods placed in strategic spots to receive the varying impulses. The electrical currents encounter different formations, and gradually a picture is built up revealing the depth of bedrock, the occurrence or absence of water-bearing sands or gravels, and similiar pertinent information.

Various types of water prospecting have been of very real service in quickly locating water supplies for Army camps and war industries in America during the present world conflict. The accuracy of the engineer was well demonstrated when a ground-water expert, upon being requested to estimate the life of a particular well, stated after pumping tests alone, that at the rate it was being used, the supply would be exhausted in nine months. The well ran dry one week before the nine-month period had passed. Modern equipment, plus the knowledge, background, and experience to employ it successfully, was responsible for this surprising accurate prediction.

Thus the ground-water expert, in addition to being a geologist, must also be an engineer of considerable ability in order to use the mechanisms of his trade. And while the scientific divining devices are marvels of inventive genius and accuracy, they are only of value when used in conjunction with other methods that are brought to bear upon the problems. A knowledge of local geological features is one prerequisite. The use of aerial photographs is another useful adjunct, for it enables the scientist to study drainage systems and other important topographical features that provide clues to subsurface conditions.

Opportunities for important investigations of the natural history of ground water will continue to attract scientists for years to come. From the small boy who lies on his stomach, dreamily watching the flow of water from a hillside spring and wondering whence it comes to the scientist who risks his life to find out the amount of water that will recharge some far-off underground supply, the subject of the source and behavior of unseen water has captured human imagination since the dawn of man! Ground-water authorities do not lack vision either, especially when they strive constantly to inform the people that this priceless commodity is essential to the existence of innumerable American homes and factories and that ground water, invisible though it may be, is by no means an inexhaustible resource.

Continued from page 347

COMMON INSECTS OF HAWAII

- - - - by David T. Fullaway and Noel L. H. Krauss

Tongg Publishing Company, $3.50
12 colored plates, 16 text figures, 228 pages

ANYONE undertaking to write a book about the insects of a fertile area of this globe—be that area part of a continuous land mass or a remote achipelago—has no easy task in setting bounds for his subject matter. In 1932 E. H. Bryan, Jr. compiled a census of the Hawaiian species of insects, which at that time totaled 4620. The aggregate is greater today. Limitations of space have compelled the authors to make a selection of only 335 species out of this abundant fauna, but their account often extends beyond the individual species to the group of which that species is a representative, thus opening up larger entomological vistas.

The information given about each species chosen for discussion includes its ordinal or its family affiliation, its general distribution, the date of its discovery or of its introduction into the islands, its habits and life history, its enemies, and—in the case of harmful insects—recommended measures of control. More unusual, each species is actually represented by a colored illustration, with indicated scale, which facilitates identification and justifies the authors in dispensing with keys. Credit is due the artist, Yasutaro Oda, for these graphic additions.

The book stresses the common insects, not necessarily those that are most conspicuous or most interesting. Abundance is, however, in many cases at least, an indication of the significance of a species in the insular economy.

Many of the insects of Hawaii belong to species represented elsewhere, and the native species, particularly those of the lowlands, have been waging a losing battle. One regrets that as a result a number of these endemic forms do not qualify as "common" and so fail to figure more fully in the account. Nevertheless, interesting facts are supplied regarding, among others, the native bees of the genus *Nesoprosopis* and the indigenous Eumenid wasps, both of which embrace many species.

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- - by The New York Chapter of the Appalachian Mountain Club

George E. Goldthwaite, $2.25
265 pages

THIS is primarily a recreational volume dedicated to the art of walking and of observing. It properly states that "the benefits and pleasures of walking as a pastime and hobby are greatly enhanced if walkers know something of the historical and physical settings of the localities and regions they visit."

With this commendable statement to serve as a thesis, the various writers of this excellent volume plunge wholeheartedly into an amazing variety of subjects. These range from legendary history through stories of the American Revolution, folklore and personalities, to the topics of geology, botany, zoology, and "impressions," all of the Hudson Highland region, largely within 50 miles of New York City. The chapter headings include: "Early Years of the Erie Railroad," "Indians of New Jersey," "The Catskill Aqueduct," "The Gremlin of the Woods" (Poison Ivy), "The Bear Mountain Bridge," "Old Appalachia or How the Hudson Highlands Got That Way," and a host of other diverse considerations.

The enthusiasm of the authors is contagious and is only paralleled by their courage in striking out boldly, regardless of the intricacy or scientific involvement of some of the subjects. Without hesitation they describe many millions of years of geologic history, the life history of ants, and the exceedingly complex and little known story of a Revolutionary highway bandit who was hanged for his sins. The absence of a bibliography or of any allusion to source material is to be regretted.

There are highly interesting chapters on the heights of mountains near New York City, the snakes of the area, the Jackson Whites, and the history of the Appalachian Trail. One of the best articles tells of that crowning botanical glory of the Highland, the Mountain Laurel. In concise, colorful language, it relates the salient facts of its life history and describes the significance of this beautiful plant in the early days of the country's development. *In The Hudson Highlands* is well written and adequately illustrated. It will stimulate many to go forth and observe as they walk the woodland trails. It is a book that fills a need we have had for a long time. To one who lived for many years in the heart of the Hudson Highlands and through force of circumstance found it necessary to abide permanently thousands of miles away, this book brings an almost overpowering sense of nostalgia.

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NEW CROPS FOR THE NEW WORLD

- - - - - edited by C. M. Wilson

The Macmillan Company, $3.50
295 pages, 32 illustrations

THE war has focused the attention of many people on the urgent necessity for the Americas to become as nearly self-sufficient as possible in vital and strategic plant, animal, and mineral materials. Plants and plant products which America in pre-Pearl Harbor days blithely imported from Europe, Asia, and Africa can and must now be grown and produced in the Western Hemisphere. Millions of dollars are being spent, and the labor of armies of workers is being expended, to introduce and establish new essential crops in the Americas. In time of war it is expected that these will help bring about hemisphere security through self-sufficiency; in time of peace they should prove most highly beneficial to a diversified inter-American economy.

In this handsomely illustrated book the fascinating and often exciting stories of over 200 of these new crops are told briefly and entertainingly. Fourteen recognized scientific authorities in botanical, horticultural, and agricultural fields have contributed chapters on rubber, drug and medicinal plants, forest resources, oils and waxes, fibers, fruits, insecticides, silks, bamboos, peppers, cane sugar, ornamental flowers, livestock, and a host of related subjects. There are descriptions of vast rubber plantations hewn out of Amazonian jungles; of the romantic international history of the Andean "fever tree"; of plant silks that are replacing the ancient silkworm; of "fish poisons" that now bomb man's insect enemies; of mango and avocado, lichee, kaki, and cherimoya; of belladonna, gambir, and ipecac.

Even so, the story is far from complete. No one book of this size could adequately discuss all the crops involved in this "biggest and most beneficial shifting of crops in a century." Yet one wonders if guayule, cryptostegia, and kok-saghyz, cork, balsa, and black pepper, vanilla, sisal, hemp, digitalis, and curare—to mention just a few—would not have been as worthy of inclusion as were cattle and corn, which are hardly "new crops."

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LETTERS

SIRS:

Can you give me some information about cormorants and their fishing activities? This summer at Georgian Bay cormorants were observed for the first time nesting on the shoals outside the ring of islands. Ardent fishermen of the district were alarmed, fearing a depletion of the Bay's fish supply—chiefly small-mouthed black bass. I have somewhere read that cormorants take "chiefly slow-moving, bottom-haunting species such as, for example, the sculpin which is unfit for human consumption." This was denied by the finding of approximately 10-inch black bass in every one of the 20 nests discovered.

In this particular place the birds were identified as Brandt's Cormorants, yet were also described as "all black." As you see, there seems to be much information and mis-information which I am anxious to straighten out.

A group of local fishermen who discovered the birds have obtained permission to exterminate them next spring. There were 20 nests on one shoal this summer. Could these birds, in your opinion, increase rapidly enough to deplete the bass in a bay the size of Georgian Bay?

MURIEL THOMSON.

Aurora, Ontario, Canada

* * *

The following information is offered by Dr. Robert Cushman Murphy, Chairman of the Department of Birds at the American Museum of Natural History:

The cormorants that have begun to invade the Georgian Bay region are in all probability double-crested cormorants, the only species common in the interior of northern North America. One of the foremost authorities on this bird is Dr. Harrison F. Lewis of the Canadian National Parks Bureau at Ottawa. He should by all means be notified of your present problem.

Cormorants in general are not very discriminating with reference to the fish they eat. Consequently the kinds which man regards as food and game fish are always likely to be found in the bill of fare of these birds. Nevertheless, it has been shown beyond question that the principal prey of cormorants consists of species which have little value to man and which indeed are likely to be the enemies of more desirable fishes because of their spawn-eating propensities. Studies made along sea coasts and in bodies of fresh water in several different parts of the world have shown that the destruction of cormorants sometimes works against the very aims that fishermen cherish. The question to be decided is not whether the birds eat a certain proportion of valuable food and game fish, but rather whether their total consumption of food is likely to be advantageous or otherwise from the human point of view. Certainly there is nothing to recommend the snap judgment of fishermen on this question. Rather it should be decided upon the basis of a competent ecological investigation.

* * *

SIRS:

. . . It may interest you to know that I have several copies of NATURAL HISTORY Magazine that have traveled 15,000 miles, and will have covered about 23,000 miles

Continued on page 392

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The Magazine of the American Museum of Natural History

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VOLUME LIV—No. 9 * * * * **NOVEMBER, 1945**

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From a Kodachrome by Harry L. Johnson

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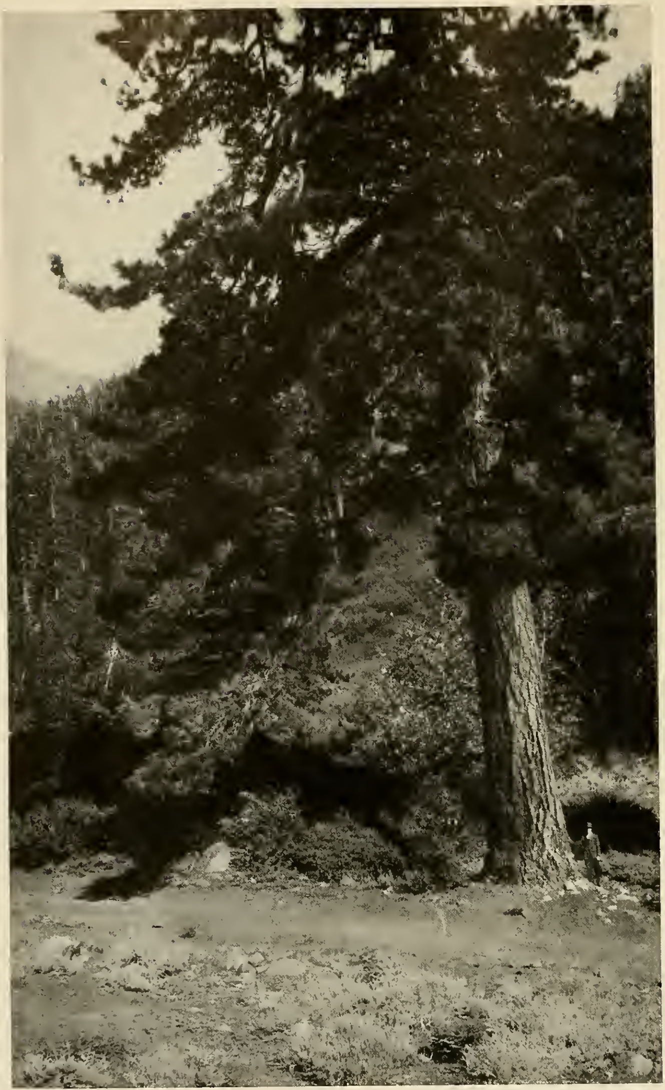

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before I get them home again. They were donated to the U.S.O. by someone in San Francisco, were given to me in Baranquilla, Colombia, and are now on Okinawa! They have been read by quite a few people, too.

LT. H. GORDON HANSON.
c/o F.P.O., San Francisco, Calif.

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REPTILES OF THE PACIFIC WORLD

- - - - - - - by Arthur Loveridge

The Infantry Journal, Fighting Forces Series, $.25, 243 pages, 70 figures
The Macmillan Co., $3.00

DESPITE the admonition that natural history pursuits were "all very well as a pastime, but not to be considered seriously as a remunerative occupation," the author of this book decided to become a museum curator at the age of ten. As a young man he journeyed to Africa to become Curator of the Nairobi Museum in Kenya Colony. As a volunteer in the East African Mounted Rifles during World War I he continued his collecting efforts (despite unsympathetic sergeant-majors) along with his military career. For the last two decades he has been at Harvard's Museum of Comparative Zoology. He is well provided therefore, with both the knowledge and experience essential for the preparation of this handbook.

Reptiles of the Pacific World is written for, and the Introduction is addressed to, "the Men of the Armed Forces," not as a technical guide, but as a readable, practical introduction. Couched in simple language, with a liberal sprinkling of colorful and illustrative anecdotes, the book was designedly made interesting, and yet its practical purpose was not neglected. General information is sandwiched in unobtrusively, along with keys and highly interesting life history notes dealing with both reptiles and amphibians from the tuatera, through the turtles, crocodilians, lizards, snakes, frogs, and toads inhabiting the vast Pacific region.

The task of assembling, sorting, and arranging the scattered information in usable and readable form was a tremendous one. By virtue of his training (and his experience in the field far removed from libraries) Mr. Loveridge was able to exercise admirable judgment, not only in deciding what to include but in deciding what to leave out.

Not only occupation troops but the professional museum curator who has long recognized the need for a general work on this subject will be pleased that Mr. Loveridge chose to ignore the warning as to the pecuniary disadvantages of a naturalist's career. As many service men will discover, there's more solid enjoyment in natural history pursuits than he can find in the "canned" entertainment that he has to buy.

C. M. BOGERT.

"HERE IS INDIA"

- - - - - - - - - - by Jean Kennedy
With photographs by Alice Schalek and others

Charles Scribner's Sons, $2.75, 154 pages

WITH a very intimate knowledge of India, having lived there for many years, Jean Kennedy, born of American and British missionary parents, writes well and very interestingly of just the things we want to know concerning this colorful and potential land which so teems with multitudes of humanity.

Convincingly and easily narrated in a straightforward manner, this very neatly printed little book contains an amazing amount of most interesting information. The author tells of the fundamentals behind the uphill struggle of these industrious people, impeded by religious castes, great concentrations of wealth, and nation divided by many absolute and independent states. You walk quietly with her in their humble homes as they go about their daily lives, and she points out the significance of the customs and describes many of the lesser but interesting episodes of the household routine. Pleasantly free from statistical data, she tells of the great natural wealth, of potential industries, of the unlimited amount of good labor, of the crying need of storing the all-beneficent water of the great rains.

Now on the threshold of a new era under our new one world, with their old and new industries which can bring them a more progressive and prosperous life, they still find all too many impediments confronting them. How all these can be overcome no one knows, but to read Miss Kennedy's very excellent book with its remarkable amount of palatable and easily digested information on the multiplicities controlling the lives of these people, is to have the best possible information on this subject which is one of the world problems of today.

I know of no book that will give the average reader more pertinent and up-to-the-minute knowledge of the Indian's own problems in such a pleasant readable form as *Here Is India,* and I heartily recommend its reading.

JAMES L. CLARK.

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TALKING TO THE MOON

- - - by John Joseph Mathews

University of Chicago Press, $3.00
244 pages

JOHN JOSEPH MATHEWS, a member of the Osage Indian tribe, is a graduate of the University of Oklahoma and has a degree in natural science from Oxford University in England. He is the author of *Wah' kon-tah: The Osage and the White Man's Road,* and of a novel of the American Southwest, entitled *Sundown.*

Talking to the Moon is a description of ten years of the author's life in a cabin he built on a ridge among the Blackjack Oaks not far from the old Osage agency. This sandstone house, although much more substantial, will remind one of Thoreau's cabin, and the book with its treatment of plants, animals, and weather, and its philosophical discussions, will make one think of *Walden.* Or, one will be reminded of John Burroughs's Slabsides and his essays, such as "Wild Life About My Cabin." Although Mathews is a gifted literary naturalist, he should be classed with the hunter naturalists along with Theodore Roosevelt, for he is as fond of hunting as was our naturalist president.

Following an introductory chapter on the building of the Sandstone House and one on the Blackjacks, the book is divided into twelve chapters, titled by the twelve moons of the Osage. The Buffalo-Pawing-Earth Moon (June) is particularly interesting, being mainly devoted to the ceremonies of the Osage. The author considers that he has been "extremely fortunate to be a witness to the last struggle of a native religion," and that "the passing of a concept of God seems to be almost as poignant as the passing of a species." The chapter of the Moon of Yellow Flowers (August) contains a fascinating description of the securing of portraits of a dozen old-time members of the tribe for the Osage Indian Museum. The chapter head-pieces

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were drawn by the famed botanist, Paul B. Sears, and the text illustrations by the author.

How the Osage came to call November the Coon-Breeding Moon is difficult to understand, since all the hunters and mammalogists that I have consulted agree that the coon mates in late January or during February, and this coincides with my own observation. Among the Ojibway, I believe February is the Coon Moon, as it should be. And naturalists will surely question the author's interpretation of the story of the mother or some other coyote bringing poison to the imprisoned young one, and the similar story of the young blue jays being poisoned by their parents.

The author gives in this delightful book the philosophy of a naturalist, who wished to get away from the artificiality and the crowded conditions of our so-called civilization. In it he discusses some of "the results of the biological urge which inspires the wood thrush to sing and the coyote to talk to the moon."

CLYDE FISHER.

PLANT LIFE OF THE PACIFIC WORLD

- - - - - - - by Elmer D. Merrill

Infantry Journal. 298 pages, 252 drawings of plants, 2 maps. $.25
The Macmillan Co., $3.00

HERE is a book for the serious student as well as the layman. It is the Fighting Forces Edition of the latest of the Pacific World Series of handbooks, prepared under the auspices of the International Committee for the Protection of Wild Life. A trade edition will be issued soon by The Macmillan Company.

In the foreword, Fairfield Osborn calls this "an unusual book." Indeed it is. For in 298 pages of well organized text Dr. Merrill has succeeded in giving a remarkably broad and comprehensive, yet familiarly detailed view of the plant life of a very vast and complex region. The book takes in all the Pacific islands except New Zealand and a few minor southern ones, with special reference to the tropics, particularly Malaysia, and notes on specific islands and island groups including the Aleutians, Japan, Hawaii, and the Galápagos.

Starting with travelers' tales of the largely imaginary perils of the tropical forests, which are humorously debunked, the author further introduces his subject with a chapter on general principles of botanical classification and explanations of the simple descriptive terms used in later chapters. Sketches of the seashore vegetation, mangrove swamps, secondary forests and open grasslands, and of the primary forests are followed by discussion of noteworthy plants such as ferns, orchids, and strange parasites, and such phenomena as cyclic flowering and symbiosis between plants and animals.

There are chapters on jungle foods, on weeds and cultivated plants, telling whence and how they came to the islands, on the distribution and origin of local plant names, and a most valuable discussion of the problems of plant distribution in Malaysia and Polynesia.

Attention is drawn to the great opportunities that remain in botanical exploration and study, especially in the large islands from Sumatra eastward to New Guinea and the New Hebrides. About 45,000 species of higher plants are already known from this vast region, yet only Java, (and to a lesser extent the Philippines), have been adequately explored for plants.

There are instructions for preparing botanical specimens, a selected bibliography, systematic list of the plants discussed, glossary, and index.

This book will fill a long-felt want. The style is direct and very readable, the drawings excellent, though some have

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suffered through reduction to fit several to a page. Few could have attempted a work of this kind and scope; only Dr. Merrill, with his great personal experience of the islands and distinguished background of research, could have done it so well.

L. J. Brass.

PAY DIRT

- - - - - - - - - by J. I. Rodale

Devin-Adair Co., $3.00, 242 pages

THIS book is an impassioned plea for a wider use of composts and mulches and a bitter denunciation of chemical fertilizers and insecticides. It contains much data, many interesting facts, and quite a few statements that are highly interesting if they are true. The author is so convinced of the fundamental soundness of his position and the importance of organic gardening that it has become a religion with him.

This reviewer has for many years believed in composts and mulches and does not need to be sold on nature's method of soil conditioning. There is nothing in the interesting description of the cycle which returns vegetable and animal wastes to the soil to provoke disagreement. The part played by earthworms, by soil bacteria, and by all the vast micro fauna and flora which nature employs for the purpose should be known to every gardener. It is truly a fascinating story.

But the complete account of the soil and the plant and animal life it supports is a highly complex one. It involves so many factors as yet imperfectly understood that it is dangerous to become dogmatic in asserting the omnipotence of any small group of these factors. The widespread use of chemicals both as fertilizers and as insecticides undoubtedly leads to abuses, but the author will find few readers ready to accept his sweeping indictments of them.

This book resembles Faulkner's *Ploughmans Folly* in the reactions it will provoke. I imagine most readers with practical gardening experience will disagree with Rodale on many of his claims. But the book will make a useful contribution because it does stir people up. However, it suffers from repetitious style and reminds one of music based upon a "theme and variations."

Compost is great stuff and Rodale never lets you forget it.

H. E. Anthony.

SCIENCE YEAR BOOK OF 1945

Edited and with an introduction

- - - - - - - by John D. Ratcliff

Doubleday, Doran and Co., $2.50
224 pages

THIS is the fourth annual volume of this popular-science series edited by Mr. Ratcliff. Following a readable and quite thrilling introduction on the advancement of science, the main body of the book is made up of outstanding articles for the lay reader from the various magazines of the country, only one of the 28 chapters having come from a book. There are ten chapters devoted to medicine, including such subjects as Penicillin and Cornea "banks." Nine chapters treat of subjects in physics and chemistry, including "The Electron in Industry," by Waldemar Kaempffert; one on War Research, being largely the work started and directed by Dr. Vannevar Bush; and two on DDT, the new insect killer. There are five chapters on aviation, including "Tomorrow's Airplane," "Rocket Ship," and "Buzz Bombs." In Part IV, titled "Other Sciences," is an interesting and dependable article on "Arctic Oil," by Wallace E. Pratt, calling attention to the untapped reserve in north-polar regions.

The next-to-last chapter, entitled "When the Comet Struck," is an unfortunate inclusion. In the first place, the theory that the Carolina Bays are meteoric in origin is presented with too much assurance. Even the speed of the "comet," as it is called, is given as 144,000 miles per hour,—a "comet" that in all probability never existed. In his recent book, the late Prof. Douglas Johnson, famed geomorphologist and geologist, convinced most students that the Carolina Bays are not meteor craters at all. In this chapter, in the account of the Siberian meteor-fall of 1908, which the writer says was probably a detached fragment of the Pons-Winnecke Comet, we are told that Farmer Semenow was just knocked senseless, while a fraction of a second before, a herd of 1500 reindeer was destroyed so completely that of all of them only a few charred carcasses were ever found.

It is stated that the articles were chosen for their readability and reliability, and this reviewer feels that the editor has achieved his ideal on the whole very well. In spots, however, there seems to be too little regard for the distinction between fact, theory, and hypothesis.

Clyde Fisher.

THE STORY OF THE DUTCH EAST INDIES

- - - - by Bernard H. M. Vlekke

Harvard University Press, $3.00
33 illustrations, 4 maps

THIS is an abbreviated version of the author's earlier book, *Nusantara*, reviewed in NATURAL HISTORY in January, 1944. Like *Nusantara* it gives the history of the Malay Archipelago from prehistoric times to the first half of 1942, thus including the Hindu, Mohammedan, and Colonial periods, the rise of Indonesian nationalism, and the Japanese invasion. To all those who wish to obtain an over-all picture of the history of the East Indies without going into the more detailed discussions in *Nusantara* this very readable new edition will be very welcome and may be highly recommended.

R. von Heine-Geldern.

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THE HAWAIIAN MONGOOSE—*friend or foe*

By LEWIS WAYNE WALKER

Photographs by the author

HAWAIIANS have a simple answer to the plural of mongoose. They merely say *"plahnty mongoose,"* and they do not exaggerate. In the 60 years since the introduction of these small predators to the Hawaiian Islands, they have become the Islands' most common mammal. In 1883 the *Planters' Monthly,* a small magazine of limited distribution, proposed "the introduction of a little animal from India called the mongoose, as a destroyer of rats. He is a famous ratter, surpassing the cat or the ferret." One Hilo planter estimated that rats cost him $10,000 a year. Soon after this, and still in 1883, the Hilo Planters' Association raised $1,100 for the importation of mongoose. This was the beginning of a plan that gained momentum with each passing year.

During the next 12 months, 72 descendants of the Java Golden Brown Mongoose introduced into Jamaica in 1872 were liberated on the island of Hawaii. In 1884 Mr. Austin, a Hilo planter, said in a speech: "These fields as well as the rest were infested with rats a year ago. Now there is not a stick of rat-eaten cane to be found, or a rat." Mr. Austin also estimated "a saving of $50,000 for one year." In subsequent publications the success of the mongoose in exterminating rats was contrasted with the ineffectual bounty system used before the predators were imported. It seems that planters offered cash for all rat tails, and received many. It was later discovered that the Chinese had been cutting off the tails and freeing the rats for breeding stock.

For several years the rats decreased in direct proportion to the increase of the mongoose, and then a few plantation workers, seemingly forget-

▲ THE MONGOOSE, now Hawaii's most common mammal, was not introduced into the islands until 1883

➤ THESE LITTLE ANIMALS were imported by the Hilo Planters' Association to help control rats

It depends upon how he fits into the balance of Nature. The mongoose has done yeomen service in some localities; but G. I. Joe is to be discouraged from any idea of bringing one home as a pet

ful of the former damage by the rats, complained that the new predators were taking poultry. This prompted a speech, the minutes of which are in a *Planters' Monthly* of 1888. "They complain about the mongoose eating chicken, but the little beggars save me thousands of dollars and I could well afford to import chickens from the coast. Besides, it is only a few chickens that they eat, and I do not believe that they destroy as many as the rats used to."

For the next score of years all seemed fairly serene and, aside from freely aired personal opinions, the rats and the mongoose fought their own battles without hindrance from mankind. Then came the movement for the introduction of game birds for shooting purposes. Ground nesting quail, pheasant, and partridge were liberated. Mongoose took their toll, and the gun clubs complained that the mongoose were the cause of the decline of the native birds as well as those that were being introduced. In the light of written ornithological history the complaint contained many flaws, but it inaugurated a plan for the extermination of the mongoose. Most of the endemic birds disappeared with the clearing of wooded areas and the accidental introduction of tree-climbing rats.[*] Many birds were acknowledged to be extinct before 1883. These same hunting organizations, seemingly so concerned about the birds, advocated and maintained an open season on the Hawaiian Stilt. This marsh dweller, formerly inhabiting several of the islands, had even then decreased to about 500 individuals on Oahu.[†]

Every few months the pros and cons of the mongoose question are aired in public print. Agriculturists, through whose produce the islands are supported, are pro-mongoose; poultry raisers and hunters consider the alien predators pests to be shot on sight. The latter group created a bounty of fifteen cents per scalp and made it a misdemeanor to "introduce, keep or breed mongoose." After extensive research the planters concluded that 80 per cent of mongoose stools contain the remains of insects. Another pro argument compares the

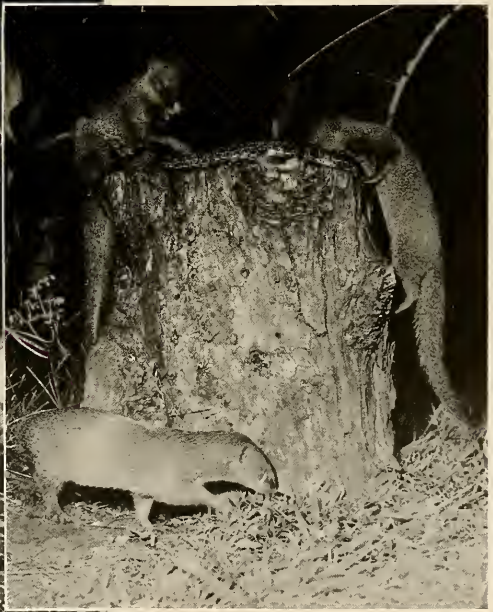
---

[*] There are apparently five kinds of rats on the islands. One of them was native to the islands when they were discovered and was thought to be an ancient Polynesian introduction. Of these five, the common Norway is the only rat that will seek escape in a ground hole when pursued by a mongoose. All the rest, along with some of the smarter Norways, have learned to live in trees and like it.

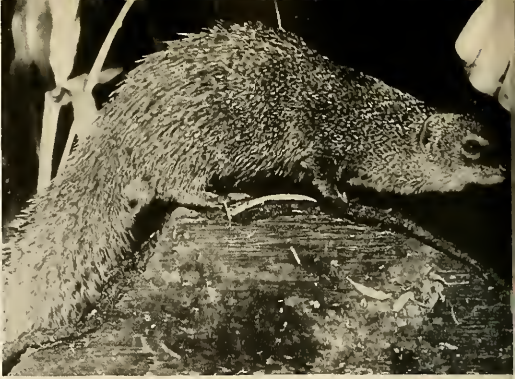
[†] In spite of the mongoose, the meager remnant of this interesting wader has actually increased during the war, owing to the restrictions on firearms.

▼ As though mimicking a prairie dog, the mongoose would rise to his fullest height every few yards as he approached the feeding station

▼ They came singly or in groups to feed at the bird feeding station



▲ ONE OF THE TAMER ONES would walk up and accept a bit of bacon held in his host's hand



▲ SEVERAL MONTHS of feeding were necessary before a mongoose would take food from human fingers

rat population of those four Hawaiian islands where mongoose reside (Oahu, Hawaii, Molokai, and Maui) with that of the islands where they have not been liberated (Kauai and Lanai). Norway rats predominate on the last two islands, while three less destructive species of *Rattus* predominate on the other four islands.

This, in brief, is the history of the mongoose of the Hawaiian Islands. When I arrived there in 1944 the servicemen were calling them squirrels, prairie dogs, and many other things. They even had one yarn which absurdly credited them with the ability to interbreed with rats! At best, the views that these newcomers obtained of the mongoose were fleeting. Occasionally one was seen darting across a road from the sanctuary of one cane field to another. Sometimes an unwary mongoose fell into an excavation and courageously charged any human that ventured into the hole.

In a secluded valley on the island of Oahu, however, mongoose and man were friends. A bird feeding station had been set up several years before my tour of duty, and mongoose had learned to partake of the proffered foods. Soon after dawn, on my first visit, while everything was still sparkling from the nightly rains, the Pekin nightingales arrived in a compact, sociable flock. The birds tried

➤ THE MONGOOSE is similar in many ways to the American skunk, to which it is distantly related. It exudes a slightly musky odor

➤ THIS MONGOOSE looks as though it were about to attack. The adversary that made the mongoose famous was the snake, but the Hawaiian Islands are practically snakeless to remain hidden in the *Ti* (a plant of the lily family), but the food lured them out. For fifteen or twenty minutes they fed in comparative peace. Occasionally these oriental birds had to side-step blood-red cardinals from Mexico, mynahs from India, or doves from China and Australia, but they withheld their wrenlike *churrs* of disapproval until the mongoose appeared.

Finally the slim body of an early riser parted the deep grasses, and he progressed with a flowing, almost serpentine motion. Every few yards, as though mimicking a prairie dog, he would rise to his fullest height. His beady eyes, with elliptical pupils, surveyed the area for danger before he continued to the station. Doves and cardinals walked to one side and allowed him to pass within three feet of them without flying, but the nightingales departed for the day.

Within a few minutes mongoose could be seen converging from all directions. Some came singly, some in pairs, and even a few mothers with twins pushed their way to the food. They were almost oblivious of the house windows and of the people watching from within. Food vanished as a dozen or more tore at the breads, fruits, cereals, and meats. More scraps from the breakfast table were hastily gathered and taken to the station. Most of the mongoose ran for cover but several walked to one side and waited. Their host of many months held a bit of bacon in his finger tips. A black nose parted the bushes and a mongoose walked from his scanty cover, took the proffered offering, and retreated.

These mongoose had never been touched or caged in any way. Their trust in people had been developed entirely by food, over a period of months. When the station was first started, mongoose were occasionally seen dashing from cover to grab a morsel before retreating. Gradually they seemed to "catch on" to the human schedule of putting the food out first before eight o'clock every morning. Their slim, graceful forms became more in evidence in the underbrush as though they had been watching the clock. Several months passed before they would permit the approach of a person without dashing to cover. From this stage of tameness, progress was rapid. They could now actually see the food being served. The tamest got the choicest cuts, hence there was an incentive to be courageous.

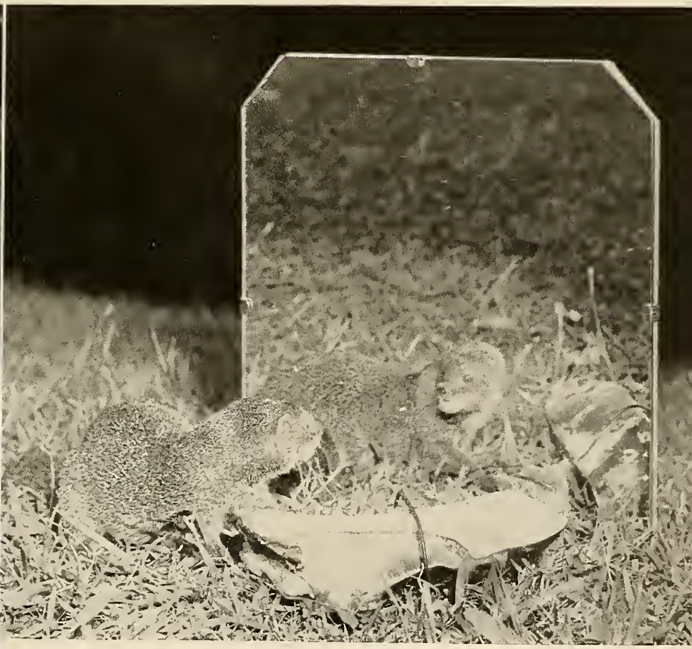
Several months of feeding, however, were necessary before courage and trust combined to cause the first mongoose to take food from human fingers. Now, at least a year later, three of the dozen or more frequenting the station are brave enough to do so. At times efforts have been made to induce them to climb upon a lap for some tasty morsel. They will start readily enough but as soon as they feel the softness of flesh underfoot, they bite with their tiny sharp teeth and run off into the brush.

From the initial visits of the mongoose, it was noticed that the regular bird visitors showed very little fear of them. The mongoose were far more intent on picking up scraps than on any remote chance of catching feathered prey. Birds in the direct path of their charge between brush and station would fly eight or ten feet and re-land more or less unconcerned. Yet a house cat walking across the lawn would make the birds nervous for several hours. If the cat disappeared into brush where it could hide, the birds would forsake the region for the rest of the day.

That the Hawaiian Islands, practically snakeless, should become a land where mongoose thrive, is in-

▼ **Contrary to general belief**, the mongoose does not depend upon reptiles for survival but is omnivorous

▼ **Friend or foe?** The mongoose does not know what to do with its own image



congruous. The one snake, which by popular conception would be termed wormlike and not reptilian is only found at two localities on Oahu. This worm snake rarely exceeds six inches in length and spends its entire life burrowing in the earth. It was probably brought to the islands within the last 50 years in the roots of imported plants. There are four species of geckos, or night lizards, and several species of skinks, which no doubt also reached the islands as stowaways, but their arrival dates from the misty past of the ancient Polynesian migrations. Reptiles are not essential to the survival of the omnivorous mongoose, which will partake of a wide variety of foods, such as insects, meats, and fruits. They seem especially fond of papayas. As tree-climbers they are practically helpless and therefore only devour fallen fruit. Rats, however, do considerable damage to the fruits raised on the islands and have learned to escape the mongoose by spending most of their lives in the trees. This habit, combined with the rodents' choice of nocturnal hours, undoubtedly has prevented the complete extermination of the rats. I have never seen a Hawaiian mongoose out at night, and even those that have been hand-raised and tamed turn in at dusk.

Twins are the rule

Unlike most wild animals, mongoose do not seem to have a definite breeding season. Only during the months of October, November, and December are new-born pups not in evidence. They probably raise two or three broods a year, with two pups to a litter. Out of several score of family groups under observation only one mother had triplets, and one of these three was obviously a runt and disappeared in about a week. The young are kept hidden until they are well able to walk and run, or until they are about one-fourth grown. When first venturing from the burrows in company with the parent they are shielded under the stomach and widely spread tail and are extremely hard to see. At such times the mother becomes very shy, rarely bringing her family to the station when it is crowded with others of her own kind. Strangely, these young seem to survive under a white flag of truce until they attain a certain size. We have sometimes seen them slide from the protection of a parent and partake of foods being eaten by other mongoose, without retaliation. If another adult tried the same tactics, a fight would result.

The mongoose are similar in many ways to our American skunks, to which they are distantly related. They exude a slightly musky odor, and the males seem to use certain trees or branches as signposts. Like skunks, their danger signal is an uplifted tail and an arched back. A mongoose pestered by one of smaller stature will often put on a skunklike dance with forefeet before charging to battle. Some of these battles are humorous. There seems to be a Marquis of Queensbury code which in some ways is difficult to understand. Some charges will be met head-on with slashing teeth. These mix-ups rarely last more than a few seconds before the defeated one retires. Other charges, and these are usually against a smaller opponent, are met with a shoulder, hip, or fluffed tail. In this case, where there is obviously no acceptance of the challenge, the agressor moves off as though defeated. Strangely in all these battles there has never been any sign of bloodshed or injury, yet with a single bite these same animals can crush the backbone of a full grown rat.

After a filling meal they occasionally like sunning or playing. If a sunbath is desired, they lie on one side at some spot where their back is protected by dense brush or logs. They stretch and roll but always keep on the alert for danger. When they feel like romping, and I believe they outgrow this with age, they have rough-and-tumble fights like a couple of kittens, pursuing and tripping each other in turn.

It is generally felt that the introduction of mongoose to Hawaii was essential and that without their aid in reducing a steadily increasing rat population the cane industry in some areas would have been doomed. (In Puerto Rico the depredations of rodents forced several plantations to close.) However, most botanists and ornithologists of the islands agree that the necessity for the mongoose was caused by a breaking of the island's balance of nature by the introduction of rats. Had there been native predators, such as skunks or weasels, the alien rats could have been handled by home talent. The great majority of birds native to the islands are passerine (perching) and, therefore, were not overly molested by the terrestrial mongoose. A few species, such as the endemic coots, gallinules, stilts, and short-eared owls are ground nesters. The first three nest and reside in marshland areas which are rarely frequented by mongoose, but the short-eared owl, a good ratter, has almost disappeared. Mongoose have, no doubt, taken their share of this beneficial bird, but many people believe that the burning of the cane fields (owl nesting areas) before harvesting is the main cause of their rarity.

Danger of importation

Some attempts have been made to introduce these naturalized Hawaiian mongoose into other areas, either as pets or as an aid in rat control. Luckily these have failed before the predators have become established. One crateload was shipped to San Francisco many years ago but was immediately destroyed on reaching port. Had these animals been liberated and become acclimated, they undoubtedly would have wrought great havoc. While the mongoose were eliminating rats they also would have been preying on the marsh hawks, short-eared owls, baby skunks, and other rat killers which are a part of the natural balance of the United States. Their depredations among the ranks of the so-called game birds and the scores of ground-nesting, insect-eating birds could have been disastrous.

Soon after the San Francisco consignment was destroyed, a congressional law was passed strictly prohibiting the importation of mongoose. One legislator at that time accredited them with unheard-of characteristics, claiming that the fierce beasts would tackle *venomous* boa constrictors with immunity and that they had six litters a year, consisting of from five to ten young each. Aside from the fact that boas are not venomous and that the mongoose is not immune to snake poisons and that they have two, rarely three, young to a litter, the basic idea of his crusade barring mongoose was commendable!

At the present time thousands of military personnel are passing through the Hawaiian chain and other islands where the mongoose reside. Some baby mongoose are being captured and raised as pets. Attempts to smuggle them through the quarantine will undoubtedly occur. In most areas their beneficial acts would not outweigh their depredations as they have in the Hawaiian chain.

DDT —the Atomic bomb of the Insect World

◄ A close-up of DDT powder

Scientific tests with the powerful new insecticide help to define its value and its limitations. Important precautions are offered,—because it kills many innocent creatures and should be marked "Poison" on the family shelf

By C. H. Curran

Associate Curator,
Department of Insects and Spiders,
The American Museum of Natural History

For three years we have been waiting impatiently for the release of the sensational, world-renowned insecticide known as DDT. Today we can buy all we want of it. Now that we have it, what are we going to do with it? Are we going to use it wisely to control a certain number of pests for which it is particularly suited, or are we going to use it indiscriminately and possibly damage the life of our planet quite seriously? DDT is amazingly good —but it is also dangerous. If improperly used, it might actually prove more devastating to man's economy than the atomic bomb.

DDT is one of the most efficient insecticides we have, and it saved tens of thousands of lives during the recent war, but we must confess that we know too little about it even to guess at its true value. Potentially, it offers us the opportunity to eliminate certain insect-borne diseases. It may reduce the ravages of many household insects to negligible proportions, and it may prove of value in the control of a very small number of crop pests. But we can hardly expect it to destroy all household pests or all insects that carry disease.

It is still too early to state just where and against what insects DDT should be used. In many cases the published reports of scientists are inconclusive and conflicting. The general public does not see these reports, most of which are "dry reading" unless one is professionally interested in them. The reports that have reached the public are almost all of the sensationally successful sort, and it is only within the last few months that the public has even heard that DDT might be dangerous.

▲ DDT powder looks like flour, is dangerous to fishes and other creatures, and should be used only with extreme caution

ll photographs by
Julius Postal

All of us who have experimented with DDT during the past years have recognized that we were dealing with a dangerous substance. From the very beginning, most of us were afraid of its direct effects on the human body. We knew how it affected experimental animals, such as rats and mice,—that continued dosages resulted in death. It was natural to suppose that human beings would be similarly affected. Under normal use, however, the evidence shows merely that a small percentage of people are allergic to DDT as they are to other things. In one case of which I have been informed, a residence was sprayed with DDT and the master of the house was unable to remain in it, because he developed "hay fever" as soon as he went in. No other members of his family suffered any apparent effects. DDT causes some other persons to develop an irritating form of dermatitis. But probably not more than one person in 10,000 is sensitive to DDT. Personally I have not been bothered greatly by it, perhaps because I have been suspicious of it and have been careful. But I have noticed that when I have been exposed to DDT in kerosene solution, I become nervous. Exposure for two or three days causes me to become quite irritable. Also it seems to cause me to suffer from sinus trouble to an unusual degree. All of these effects disappear within 24 hours after exposure to the material. Mr. V. B. Durling, who has been associated with me in many experiments with DDT, is rather similarly affected and in addition suffers from a backache, which may persist for some days.

In other cases there is no noticeable reaction to continued use; and in spite of the symptoms cited, I am still of the opinion that the insecticide does not bother most persons. George Severn and John Ryan, of the American Museum, have been more exposed to DDT in kerosene than any others who have assisted me in the work at Bear Mountain. Both were literally saturated with the solution every day for more than three weeks. Their work clothes were always oily and, like myself, it was possible to detect their presence by the odor. All the time that they were using the material I watched them closely. Actually, because I believe that the use of DDT is, in the present state of our knowledge, extremely dangerous for other reasons, I should have been happy if I could have reported that the spray was directly dangerous to man. But I have no evidence that it is; and the work in Italy, which was very similar to my experiments during the past summer, showed quite similar results. In Italy the men started out wearing gas masks, rubber coats, boots, and hats. These were found to be extremely uncomfortable and were gradually cast aside—first the mask, then the hat and coat. Eventually the men were wearing only shorts and shoes, and not one suffered ill effects.

It is apparent that if we were to consider DDT only from the standpoint of the way it affects human beings we could not regard the spray as dangerous, but let us consider all the evidence before we decide whether it is safe to use it as a generally applicable insecticide.

Dichloro-diphenyl-trichloro-ethane is nothing new. It does not exist in nature but was discovered by chemists more than 70 years ago. Until just before the outbreak of the war it remained one of the many scientific developments that apparently had no practical value. Then it was found to be very effective in the control of potato beetles in Switzerland. This is the generaly accepted story concerning the discovery of the value of DDT as an insecticide. A fantastic story has it that the Germans allowed soldiers who had been dusted with DDT to be captured by the allies in the belief that, although it killed lice, it was actually dangerous to human beings. There is no doubt that the Germans used DDT for the elimination of lice and the prevention of typhus before we did, and that many troops captured early in the war had been dusted with it.

From almost all the popular accounts, the world has been led to believe that DDT is the answer to all insect problems. Now that the product has been generally available in America for a few months, many people are complaining about its ineffectiveness, particularly against household pests. There have been so many complaints that entomologists have said the mixtures sold were too weak and that any solution to be effective must contain at least five per cent DDT. I have not found this to be the case but have obtained amazing results with solutions much weaker than most of those offered for sale.

Many of the household insects may prove difficult to control with DDT, but until thorough investigations have been carried out it will not be possible to do more than suggest that people try it. Up to the present it has not proved effective in the control of cockroaches. I have tested it under natural infestations, using powder with a strength of five and ten per cent and a spray containing from two to ten per cent, but without great success.

It would be surprising if inexperienced users should obtain perfect results with DDT. As a fly spray it is not as effective as pyrethrum or rotenone and is a much slower killer. Spraying rooms in the usual way is unlikely to give good results against flies or mosquitoes, since there is practically no residue and what there is mostly settles on places where flies are not likely to alight. The places where flies normally rest should be treated, and with mosquitoes the dark portions of rooms need attention. Bedbugs are very susceptible to DDT, but a thorough job must be done or results will be disappointing.

While fleas are very vulnerable to DDT, it must be used with care. The general practice is to dust the dog with a five or ten per cent mixture, rubbing the powder into the hair. The powder not only kills the fleas on the animal, but as the dog walks around and lies down in favorite spots, some of the powder drops off and kills fleas and their larvae on the floor. Cats should *never be dusted* with DDT. They lick themselves so frequently that sufficient powder may be swallowed to make the cat ill or even cause death.

Spraying the floor heavily with DDT should take care of fleas regardless of whether dogs or cats are responsible for the pests.

Some other household pests may be killed by DDT, but no perfectly satisfactory method of applying it for the control of clothes moths and carpet beetles has as yet been demonstrated. In due time suitable methods may be developed, but until then the householder should not be surprised if insect damage continues to occur.

Against agricultural pests DDT has given rather spotty results, though on the whole it is an extremely effective killer. In fact, it is too effective, and many entomologists agree that it is safe to use only for the protection of potatoes. When tried against the pink bollworm of cotton, it did a pretty good job of destroying the larvae but it also killed the insects that pollinate the cotton. DDT is now considered much too dangerous to use as an insecticide on this crop. The same will apply to a great many other crops. Nor should we conclude that is can be safely used on all crops that do not rely upon insects for pollination.

DDT is especially effective against all soft-bodied insects, least effective against hard-bodied ones. Caterpillars are readily killed by it, but adult beetles are difficult to kill. Flies, including mosquitoes, are among the most vulnerable, but we should remember that of the approximately 25,000 different kinds of flies found in the United States more than 24,500 are either beneficial or at least known to be harmless. A very large pecentage of them pollinate flowers; another substantial percentage prey upon injurious insects; while a huge group is parasitic on caterpillars, beetles, sawflies, bugs, and so on. Certain groups of flies feed on mites and other tiny creatures, and mites are not easily killed by DDT. Of course, bees and wasps are also killed, but some of them are fairly resistant and practically all of them will stand heavier dosages than the more delicate flies.

The value of some of the larger bees and flies in apple pollination in Nova Scotia has been discussed by W. H. Brittain in the Dominion of Canada Department of Agriculture Bulletin, No. 162. In addition to honey bees, some 28 other bees and 20 kinds of large flies are listed. The hordes of small flies, which are extremely abundant about the flowers of fruit trees, were not included in Dr. Brittain's report. Many of these are of considerable importance as pollinators, and since they are quickly killed by DDT, it would seem reasonable to suppose that their destruction alone would impair the setting of fruit over a period of years.

In view of this it is obvious that the general use of DDT might very quickly upset the balance of nature by destroying the pollinators as well as by eliminating the parasites and predators that are chiefly responsible for keeping potential insect pests in check. It would be bad enough to eliminate our flowering plants by doing away with the insects that pollinate them, but there are indications that the effects go far beyond that.

There were newspaper stories to the effect that the island of Saipan (it was not named at the time) had been sprayed with DDT to eliminate malarial mosquitoes before our troops landed. Actually, the spraying had nothing to do with malaria control, because the disease has never been known to exist on Saipan or adjacent islands. But it is true that the island was sprayed—many times. Pest mosquitoes were present, and so were hordes of green-bottle flies belonging to the genus *Chrysomya*. These had proved difficult to kill. They bred everywhere—in garbage, dead bodies, latrines, etc.,—and they were caught in traps by the bushel each day. It was chiefly against these that DDT was used. Today, according to information already furnished me, Saipan Island is approaching a condition of devastation. My informant stated that there was scarcely a living thing on it. No birds, no mammals, no insects, except a few flies, and the plant life was decreasing.

It seems possible that the same may happen on the island of Okinawa. On September 16 I received a letter from an officer informing me that the insects were being kept pretty well under control by DDT, adding that chickens had died as a result of having eaten insects killed by it. The symptoms were similar to strychnine poisoning. He further added that some natives who had used DDT as baking powder had died, and that post-mortems showed nerve lesions.

In America the manner in which thousands of birds were killed as a result of spraying or dusting with DDT has been debated. The fact that chickens die from eating insects killed by it seems to give the answer. Some of us had imagined that inhalation of the spray or dust might have been responsible, but none of the experiments that have come to our notice show damage to warm-blooded animals except when the material was ingested or injected.

Despite the danger of using DDT unwisely, experiments we conducted at Bear Mountain Park for the con-

▼ The DDT on sale for public use is a solution in kerosene or other solvent. It is intended solely for household spraying. Birds that eat insects killed by it will also die

trol of mosquitoes, houseflies, and other pestiferous insects during the past spring and summer, prove that it has a very important place in our national economy, and it may eventually eliminate certain insect-borne diseases.

Bear Mountain Experiments

In the work at Bear Mountain DDT was used with caution. Since the Park is a wildlife preserve and a popular fishing center, the object was to apply the insecticide in such a way that it would not interfere with the normal development of other animals. We had two prime problems: the control (1) of mosquitoes in the Twin Lakes camp area and (2) of houseflies in the Bear Mountain Inn and near-by buildings. Other problems also confronted us, such as the presence of enormous numbers of No-see-ums or gnats, and black flies.

The housefly problem really involved two separate projects: the control of flies in the stable and the control of flies at the Inn. In any fly campaign it is necessary to eliminate breeding places, and this was obviously easy to do at the stables by treating the manure with one of the common insecticides. DDT was ruled out because we did not know how it might affect the manure as a fertilizer and because it seemed unlikely that its lasting qualities were sufficient to survive the whole summer when exposed to sunlight.

In late April, when houseflies began invading the stable, the first spray, containing less than one per cent of DDT in kerosene, was applied. The results were obviously good. The stable population of several hundred flies immediately dropped to less than a dozen, and it was not until the middle of June that it again increased to about its original level. Even then the stable was free of flies each morning.

Our April spray had been quite skimpy. We were testing the equipment, and much of the material was wasted in necessary adjustments. As a result we applied less than two gallons of liquid, and one side of the stable was scarcely touched. A second application covering the whole of the stable and using a full five gallons was made in the middle of June. This, I think, was too little, since the wood was very dry and much of the DDT must have been carried well in from the surface, where it could not come in contact with the flies' feet. Despite this, the results were remarkable. Even on the worst days the fly population never exceeded an estimated 200 and in the mornings the stable was completely free of flies. As a result, the horses were able to rest during the day as well as at night, and their generally fine condition reflected the benefit they derived from the treatment.

▲ **Spraying the ponds in the test area in the Palisades Interstate Park with plain kerosene to kill mosquito larvae. Addition of DDT in amounts safe to fishes would not have been worthwhile**

➤ **The flies in the stable at Bear Mountain were easily and effectively checked by spraying DDT in kerosene**

Early in June an occasional fly made its appearance at the Inn. It was hoped to delay treatment of the building until spraying at Twin Lakes camps had been completed, but an emergency developed in the form of Punkies or No-see-ums. The season was perfect for the development of these insects, and they were a terrific pest. They are very tiny and capable of going through all but the very finest screens. They were going through the Inn screens and making the guests utterly miserable during the night. It was impossible to sit on the side porch in the evening, and since the Inn is wide open, with screening only in the bedrooms, they invaded the whole building, being attracted at night by the bright lights.

This was a problem that I had not counted upon and one which was tackled with little more than a vague hope of success. But I had told Jim Martin, the manager, that we would take care of it. In the Inn area we used a stainless type of kerosene. We

▲ **Indoors, flies and No-see-ums were quickly eliminated by use of DDT in kerosene. Against flies, saturation of light cords proved particularly effective. Properly used, DDT is a valuable insecticide; but anyone employing it should observe the precautions explained in this article**

started with only a .8 per cent solution of DDT and increased it to 1.5 per cent, though I am still far from sure this was necessary. Spraying at the Inn and adjacent buildings was not an easy task. Our equipment was not designed for throwing a high spray but we managed to spray part of the walls, the side porch, some of the eaves, and many of the screens from the outside. The screens that we could not reach were sprayed from the inside.

The results came immediately, and the guests were able to sleep in comfort. The effects lasted throughout the summer. The pests were present at a distance from the Inn, but it was possible to sit in comfort on the porch and few insects entered through open windows.

Having started work on the Inn building, we decided to take care of the housefly situation. It had been my original intention to do a thorough spray job, but there were difficulties connected with this because the building was fully occupied and the people were on the move from dawn until past midnight. So we sprayed only the light fixtures in the dining room, cafeteria, lobby, and other rooms. The kitchen presented a more serious problem, but I finally decided simply to make new light pulls saturated with a 2 per cent solution of DDT. All the light pulls in the kitchen were removed and the treated ones were substituted. Members of the kitchen staff looked at me as though I were crazy when I told them that these simple strings would control the flies. I wasn't sure they would, but—they did. We obtained excellent control, and very few flies were present. In order to insure against an influx of the pests during the late part of the season the building was again treated early in September.

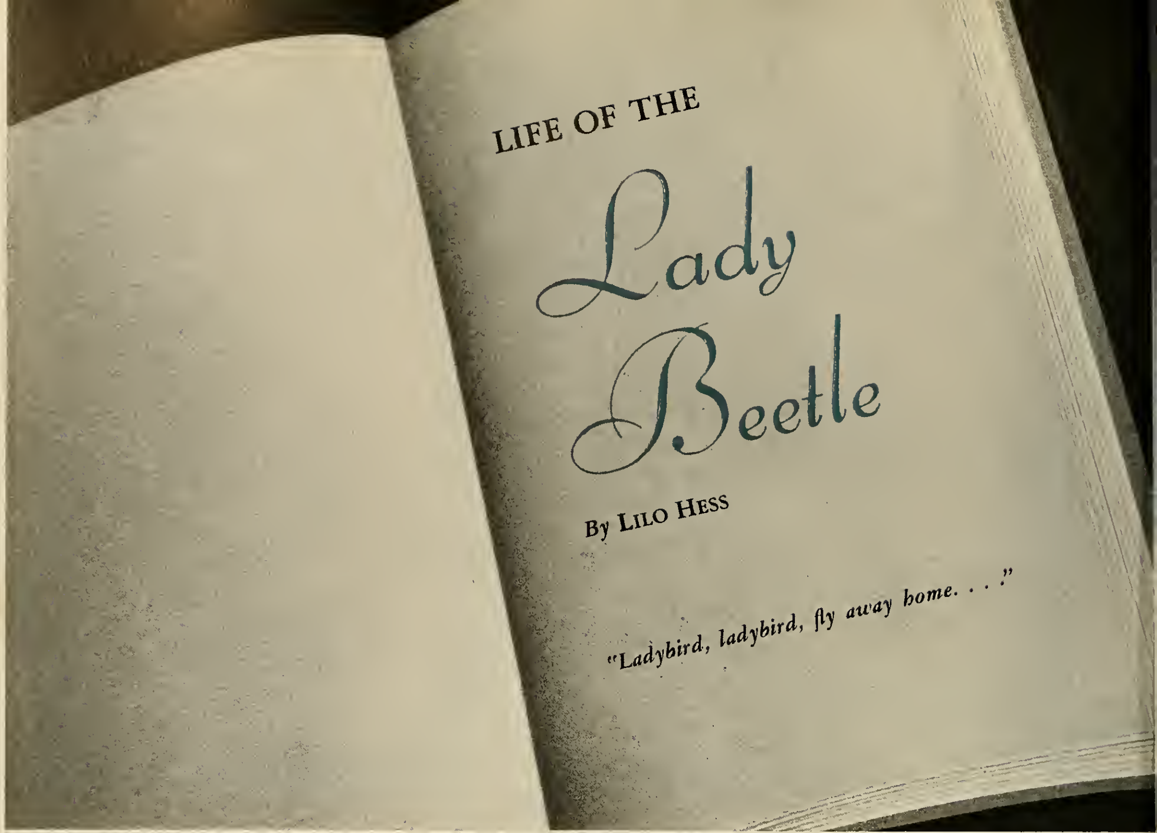
Mosquito control

The control of mosquitoes both in the Bear Mountain area and the Twin Lakes camp section constituted our largest experiment. For this we decided to use DDT only in the treatment of camp buildings. For one thing we wanted to limit our destruction of insects to mosquitoes as far as possible. We knew from published reports and from our own experiments that DDT was dangerous to all cold-blooded animals, including innumerable insects that furnish food for fishes. Also we were worried because there was a possibility that sudden floods might carry the chemical to the water supply system and possibly result in human illness. Because of these considerations, plain kerosene was used in spraying pools and swamps to destroy mosquito larvae, and a system of water level control took care of them in the large swamps.

The camp buildings, of which there were 300, were sprayed thoroughly inside and out with DDT in kerosene, with the result that within the camp area there were practically no biting insects during the whole of the camping season. There is some reason to believe that residual DDT will have some effect on them in the coming season.

Considering our mosquito con-

Continued on page 432

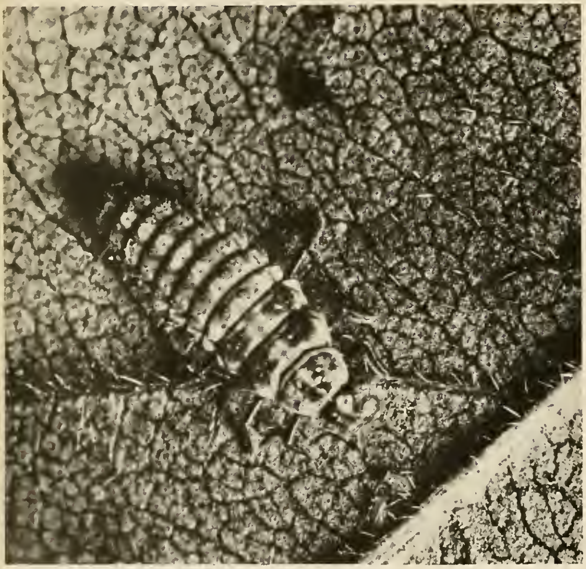


LIFE OF THE Lady Beetle

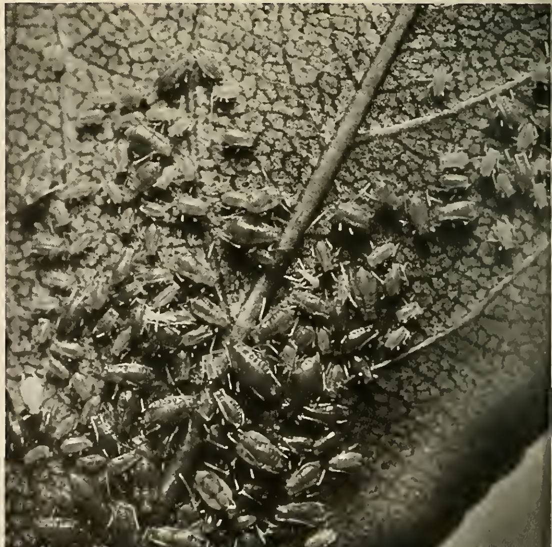
By Lilo Hess

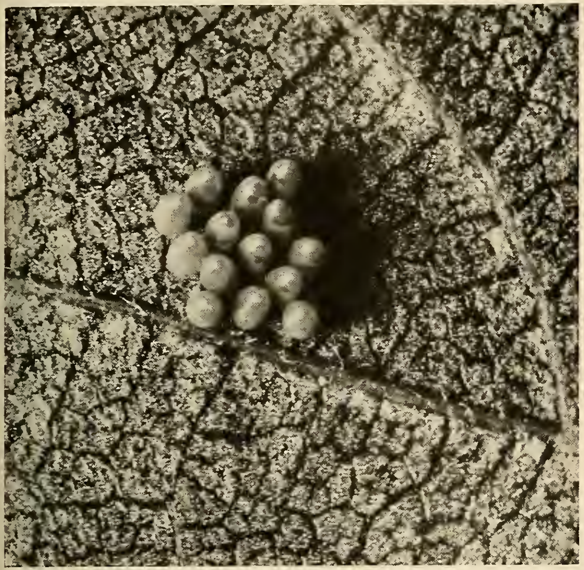
"Ladybird, ladybird, fly away home. . . ."

three The larva eats a great deal, sheds its skin frequently, and grows rapidly. After the first moulting, spots appear on its back. The larva is usually yellowish or purplish with dark spots

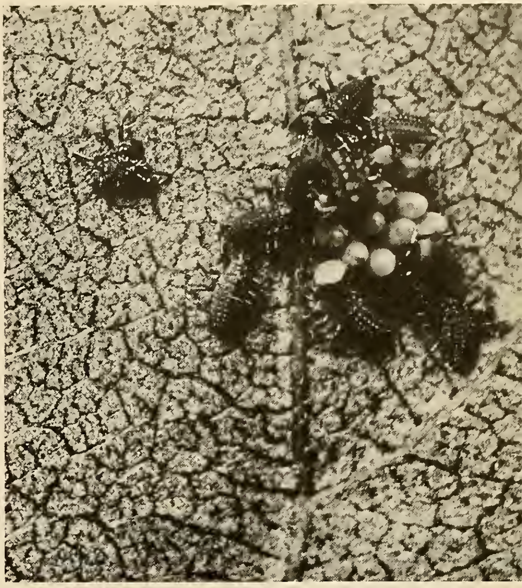


four The aphids consumed by the ladybeetle's larvae live o leaves or stems of plants, and are harmful to them. The vary in shape, size, and color, but are all relished by ladybeetles an their larvae



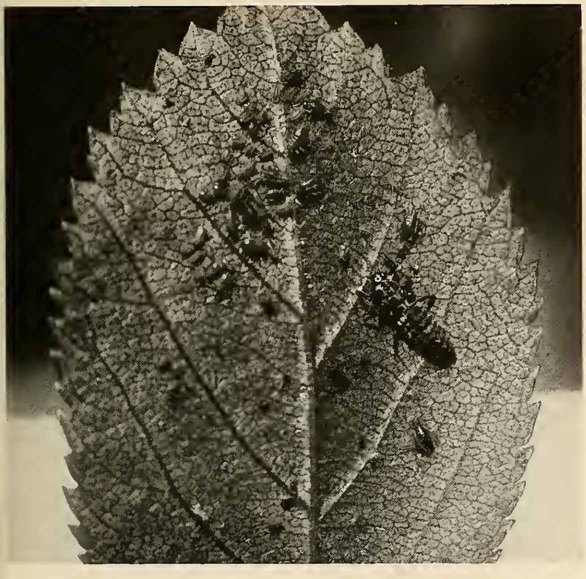


one THE EGGS of the ladybeetle are small and are of an orange or yellow color. They are laid in clusters of from 3 to 30 on the underside of leaves

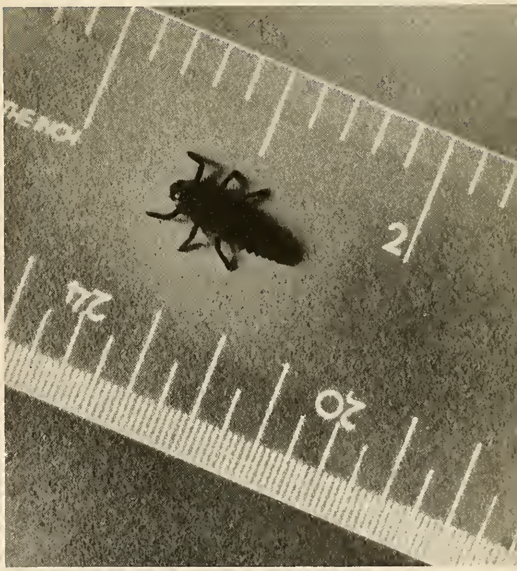


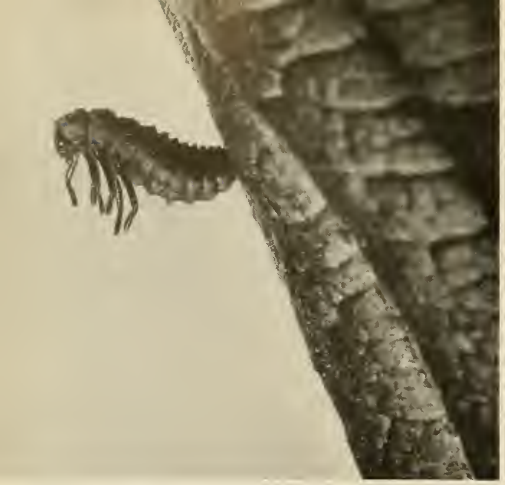
two AFTER 5 TO 10 DAYS the tiny blackish larvae hatch. They are very active and go immediately in search of food, which is never very far

five THE LARVAL STAGE of the ladybeetle lasts about 3 weeks



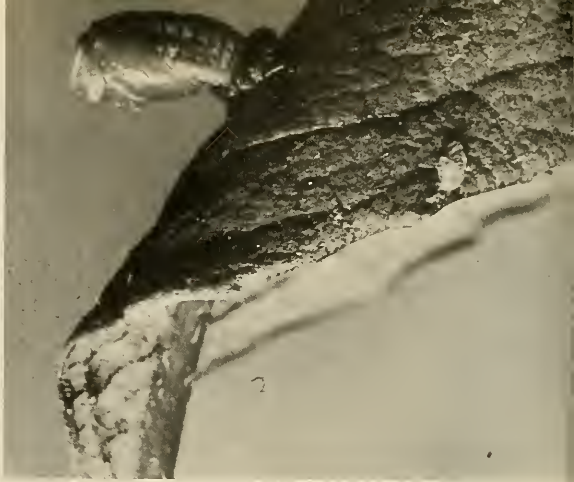
six THE FULL GROWN LARVA is almost ¼ of an inch long and quite plump. It becomes sluggish as it matures





WHEN IT IS READY TO PUPATE, it attaches itself to the underside of a leaf with its tail end and starts to fold up is legs

↑ seven

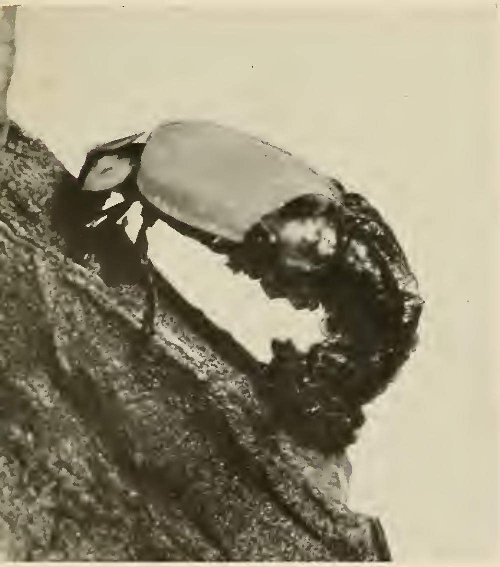


IT MOVES back and forth until, after several hours, the skin splits and slips back, exposing the pale and translucent chrysalis

↑ eight

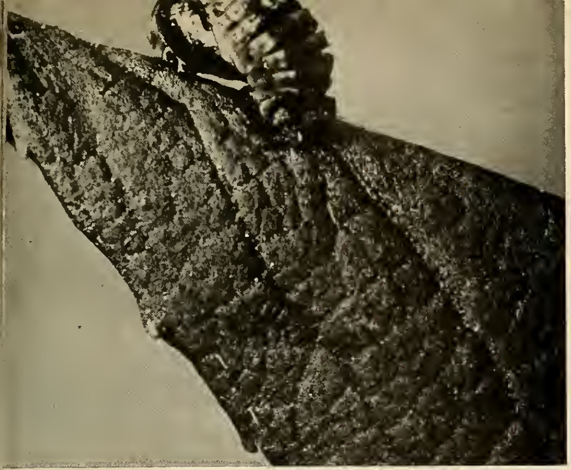
eleven ↓

WHEN THE LADYBEETLE EMERGES, it is lemon yellow and has no spots. The markings on the head are already there. The process of emerging takes but a few minutes



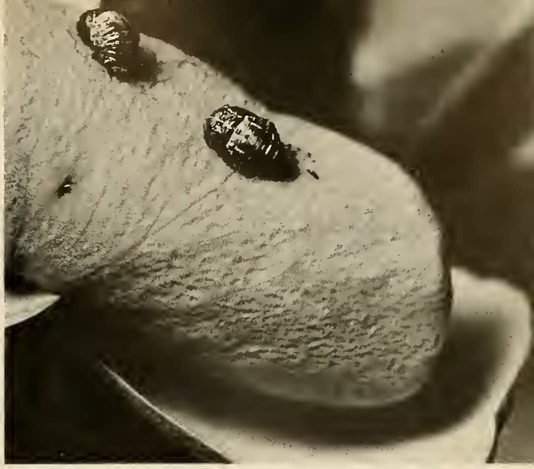
twelve ↓

AFTER A LITTLE WHILE the color changes and the spots appear. The wings look crumpled and protrude backwards. They are not folded up until later. This emerged ladybeetle is *Adalia bipunctata*



The chrysalis darkens after a while and hardens. It is firmly attached on one side to the leaf. When touched, the unattached end snaps back and forth

↑ nine

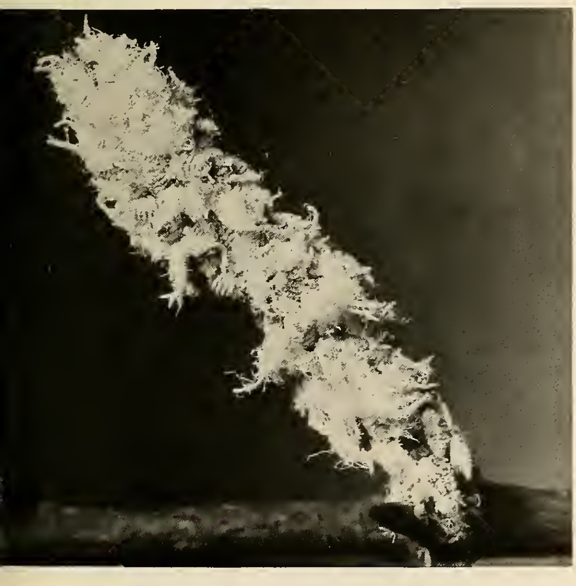


Examples of the tiny pupa can be seen almost all through the summer and fall, since there are several generations of ladybeetles in one season

↑ ten

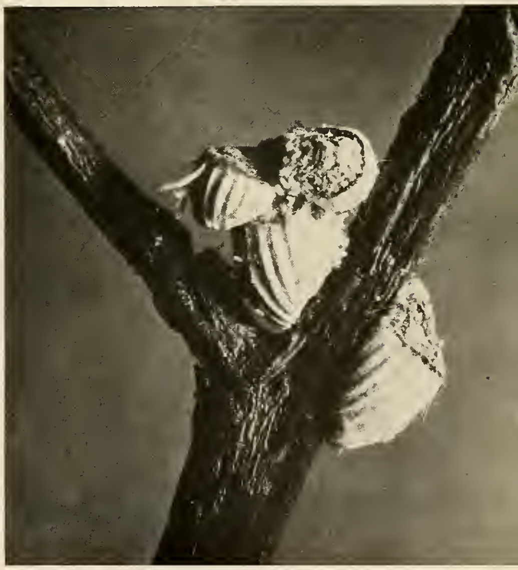
thirteen ↓

The ladybeetle is one of our most valuable insects because of the amount of harmful aphids and scale insects it destroys. A large cluster like the one shown here may be eaten up within an hour



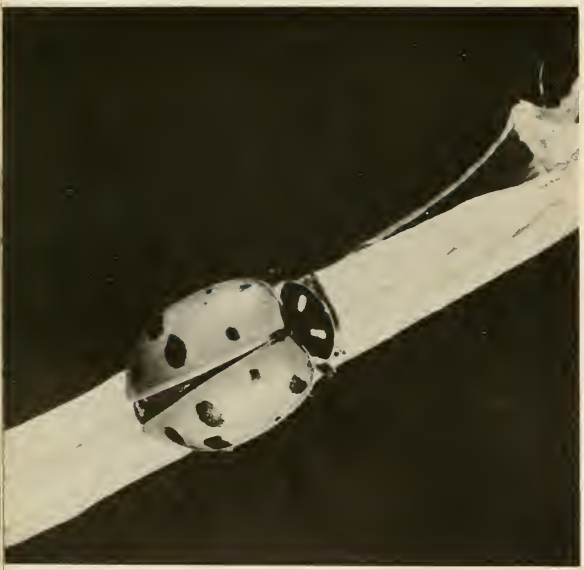
fourteen ↓

A harmful scale insect which almost destroyed our orange industry in California is relished by a certain species of ladybeetle from Australia, introduced into the United States to control this pest. Collectors now go out to gather ladybeetles in bags and distribute them to farmers. The farmers liberate the beetles in their orange groves and thus protect their crop



fifteen THE LITTLE BEETLE does not have many enemies. One way in which it protects itself is by "playing 'possum"—by dropping to the ground and remaining motionless until all danger is past. Also, it gives off a repulsive odor when frightened. A young and inexperienced bird may eat a ladybeetle by mistake, but after finding it distasteful will avoid them in the future. Red is usually considered a "warning coloration" in nature and most ladybeetles are at least partly red

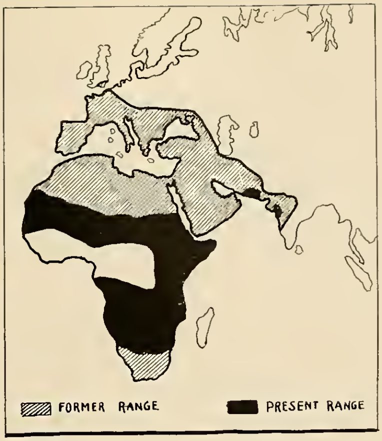
sixteen THE PRAYING MANTIS is one insect that does not seem to mind the odor of the ladybeetle and can be considered a true enemy



seventeen TWO THOUSAND SPECIES of ladybeetles are known. Some have spots, some are striped, and others are plain. Two of the more common ones around New York City are *Adalia bipunctata* and *Hippodamia convergens.* The one shown here is *convergens*

eighteen LADYBEETLES live usually not much more than a year, or even less. They hibernate under leaves, rocks, roofs, and windowsills. Frequently they hibernate in clusters. Such a cluster on a mountain height in Colorado is illusrrated in this American Museum group

NO MORE ENCIRCLEMENT



BOUNDARY DISPUTE

By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

JUST as the boundaries of states and empires shift, the geographical ranges of animals change through the years. There are ebb and flow, periods of expansion and of contraction. The King of Beasts once ruled a much larger domain than now. Today lions are restricted to sections of Africa south of the Sahara and to a few localities in southern Persia and western India. Not long ago the lions of southern Africa disappeared. A hundred years before this the lions that were once common in North Africa were exterminated. Within historic times lions roamed Palestine and Asia Minor and were found in Bulgaria and parts of Greece. During the Pleistocene, or Ice Age, they lived through much of Europe as far north as the British Isles and in southern Russia. With bears and wolves they were fearsome enemies of our early ancestors. If the California "lion," found in the Rancho La Brea tar pits, should be considered a true lion, as some students of fossil cats believe, the lion of the Pleistocene must have had a truly extensive range.

A large flesh-eater like the lion can only exist where there is an abundant food-supply,—game animals of large size. Only grasslands support herds of the large plant-eating mammals, and the lion appears to have always preferred regions where grasslands flourish. Today lions are absent from the dense rain forests of West Africa and the Congo, although they are common in brush country and open savanna forest. Deserts that are completely waterless are also avoided, but lions are found in many hot, dry regions provided there are waterholes at which antelopes and zebras gather.

The range of a species of animal may be reduced because of climatic changes, yet the lion lived with reindeer and woolly mammoth in the Ice Age in Europe, and captive lions in northern zoos stand rather cold weather without injury. It may have been failure of the food supply that caused the lion to vanish from western Europe at the end of the Pleistocene. At the same time, the lion was probably prevented from spreading eastward by the tiger. These two great cats, about the same size and closely related, seem to be mutually antagonistic, and the tiger appears to be the more powerful and better suited to conditions in India. It is a general rule among the back-boned animals that the closest relative of a species does not share the same territory but lives in an adjacent area.

Man, however, has been the chief enemy of the lion, and it was he who wrested much of the territory from the King of Beasts. The Egyptian, Assyrian, and Persian kings and nobles hunted lions with bow and arrow, partly for renown and as training for war, partly to benefit the peasants whose livestock the big cats raided. The cattle-herders of southeastern Europe and Asia Minor were natural enemies of the lions living in those regions and hunted them down. Against men working together, even when poorly armed, the large beasts of prey cannot defend themselves. Lions first were reduced in numbers, then destroyed in the settled areas of Egypt, the Near East, and Europe. When guns were added to the other weapons, the extermination of the lion in North and South Africa was certain. Only in national parks and in parts of Africa unsuitable for settlement will lions persist in their wild state.

Through unexpected circumstances came the
rare opportunity of witnessing the private
life of this normally wild bird of the desert

Watching the White-Winged

By William H. Carr

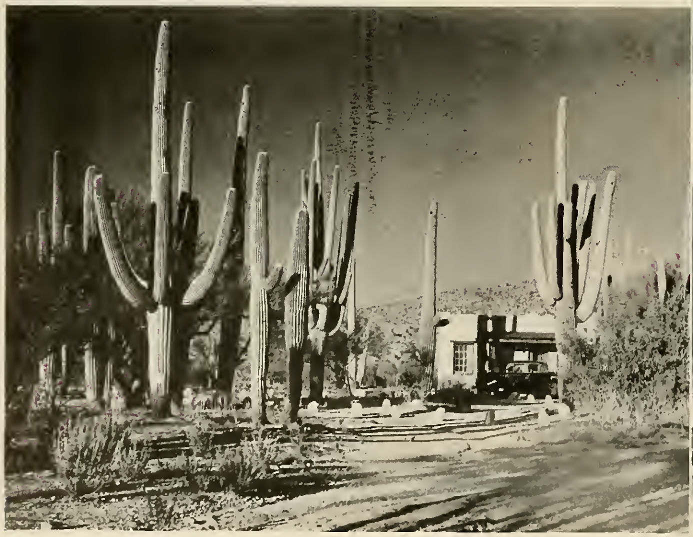
Photographs by Marvin H. Frost

Good fortune often plays into the hands of the exploring naturalist who seeks one thing only to discover something more unexpected. An unusual sequence of events was responsible for my making the acquaintance of a normally wild bird, with a degree of intimacy surpassing all my expectations. It happened because a White-winged Dove built its nest in a paloverde tree in a desert turkey yard and a glistening black colt got a cholla in his nose. Each link in this seemingly unrelated chain of incidents led us directly to the bird.

My photographer-naturalist friend, Marvin H. Frost, and I were visiting at the isolated Lazy Three Ranch, in the foothills of the Tanque Verde Mountains. We sought information about wildlife in the surrounding wilderness of thorn, spine, and giant cactus.

The colt came into view, following his mother into the open corral. I noticed at once that he was in distress and then observed the cruel

➤ **The vantage point** from which the desert dove was observed and photographed. Helen Knagge, the Ranch Lady, studies the progress of events in the nest on the Lazy Three Ranch (below), in the foothills of southern Arizona's Tanque Verde Mountains



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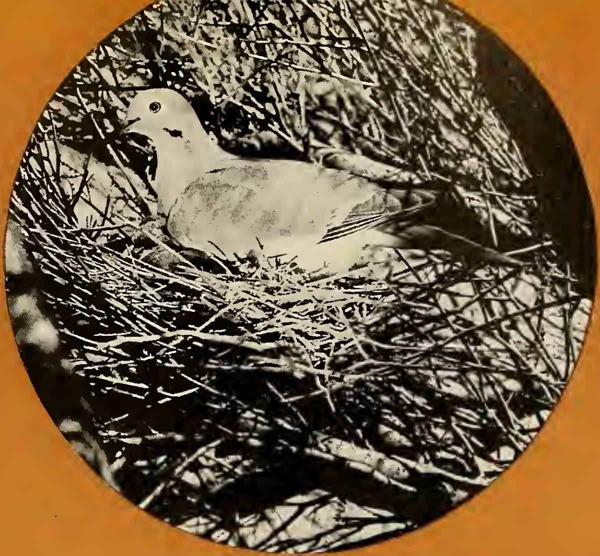


"SHE was a beautiful dove with trim, clean lines"

cholla clinging to his velvet-soft nose. For the uninitiated, this particular "cholla," pronounced "CHOY-yah," is an obnoxious, though handsome, form of plant life known as the "jumping cactus," thanks to its marked propensity for coming lose from the parent plant whenever its spines are brushed or barely touched by passing man or beast. It was obvious that the thing to do was to remove the barbs from the infant as speedily as possible. The capable and hospitable ranch lady, who acted as guide, grasped a stick and coaxed the unhappy animal until he was within reach. Then with a quick downward stroke she disengaged the offending spines with an efficiency born of long practice.

When the stick came in violent contact with the cactus, the startled colt kicked protestingly against a tin siding that separated the corral from the adjoining turkey yard. The resounding impact shook a paloverde tree that supported one end of the metal, and the woman gazed into the sparse branches with a worried expression. "I hope all the noise doesn't frighten my dove away," she said. "Liza has been sitting on some eggs for a long time and I watch her every day when I feed the turkeys. I'd hate to have her leave those eggs in all this heat. Her nest is so shaky anyway. You'd think the eggs would fall out!"

In this way I was introduced to the White-wing and its seemingly flimsy nest some twelve feet up in the desert tree. There sat the dove, shielding we knew not what. We watched from a distance of about fifteen feet and the quiet brooder showed no alarm whatever as we talked and moved about. In fact, I could never have had a better chance to observe this lovely desert bird at closer range—or at least so I thought then. She was a picture of avian grace and devotion as she sat with the utmost patience while the glaring sun appeared to be doing its best to ignite the universe. Her wings were a light gray with white showing along the folded margins, and her lines were as trim and clean as could be.

I had admired the White-wings for some months, since the time of their arrival from near-by Mexico in mid-April, when I saw them flapping and sailing over the desert with their white wing-patches flashing in the sunlight. I had watched them through binoculars as they fed from the cactus blossoms in the springtime. They would perch upon the very tops of the skyscraper plants and probe the handsome white petals seeking nectar, pollen, or insects. I never learned what they secured in the hearts of the white flowers. Later, when the red fruit of the Saguaro replaced the blossoms, the doves would feed greedily upon them.

The call of the White-wing had attracted me too. The vocal accomplishment of the "Sonora Pigeon," as the White-wing is sometimes called locally, resembles a somewhat labored "cuckooing." The bird seems to repeat over and over again, "Who cooks for you? Who cooks for you?" Apparently no one has ever answered the question.

Certainly the nest of the turkey-yard White-wing was admirably suited to the place and temperature. It was the first of many I was to see and consisted of a seemingly haphazard collection of very small, loosely interlaid twigs placed upon a small crotch in the tree. The construction, however, was certainly adequate, for it permitted available air currents to circulate from beneath and from the sides, providing whatever relief possible from the heat.

Presently, of her own volition, the bird flew off and perched upon the top of a saguaro, repeating, "Who cooks for you?" I immediately took advantage of the opportunity and placed a small stepladder beneath the nest so that I could investigate. In addition to two eggs there was a very small, unprepossessing nestling that paid no attention to the face peering over the edge of its natal platform. One of the eggs was typically that of a dove, white and slightly elongated. The other was smaller and was covered with brownish spots. It was not a dove egg but belonged to that opportunist of the bird world, the Cowbird, who lays its eggs in the nests of others, thus giving the unwitting foster parents the dubious privilege of hatching and rearing unwanted young along with their own.

I had barely had time to grasp the situation when the parent bird flew toward us and alighted upon a corral rail, to walk restlessly up and down, impatient to return to her duties. I left the spot promptly and retired a sufficient distance to ease the bird's agitation. I had scarcely gone when the dove settled upon the twigs once more and resumed her sheltering position.

The nest site was an ideal one to photograph, so without disturbing the bird further, we made plans to return the next day. The next day we arrived early to find the dove temporarily missing. Placing the stepladder beneath the tree once more, I soon learned that the cowbird egg had disappeared. Only the dove's egg and the little bird remained. I examined the fledgling closely, but it did not acknowledge my presence by any sign whatsoever. It was dark gray, almost black, and its incipient feathers were bound in tight little sheaths upon wings, sides, and underparts. Its dark eyes were closed most of the time, but occasionally it would open them and look nowhere in particular, only to close them again in the face of the relentless sun.

Mr. Frost, who had taken my place on the ladder, had barely completed making his photographs of the infant when the faithful mother once more appeared. This time she alighted on the roof of the turkey shed, six feet away, and paced up and down until our paraphernalia had been removed and we had left the yard. The bird then returned to her parental duties, almost at once.

Later Mr. Frost returned and made a photograph of the mother on her nest. In the meantime we had taken the precaution of building a temporary support so that if the bird became too nervous we could operate the camera by remote control. However, the dove permitted Mr. Frost to hold his camera practically on a level with her head and did not budge when the mechanism clicked. Neither the camera nor the photographer seemed to disturb the bird at all, then, or at any future time.

All this time we had been as quiet as possible, trying not to alarm the bird. I was amazed at her "tameness," for experience had taught me that, while it was possible to approach to within about ten feet of some White-wings, whose nests were located in the desert far from human contact, the brooding birds would nevertheless fly off if one came too close. On a later occasion I had examined a particularly attractive White-wing nest, situated in the heart of a large cholla cactus, and another on the limb of a mesquite tree. The brooding dove, in each instance, would leave the nest when I was some 30 feet away. I attributed the relative tameness of our bird to the fact that her particular nest had been placed where people frequently came and went without ever disturbing the dove.

I could never be certain of the sex of the ranch White-wing, for the male and female are difficult to distinguish. I knew that both parents took turns incubating the eggs, but I never saw more than the one bird on any of my visits. On every occasion when the bird flew off and returned, I observed that it was the same individual, for it had a slight injury on one of its reddish legs that had resulted in a blackish discoloration.

On the one morning that I was able to come early, I found the dove on the turkey-house roof waiting to enter the nest, and I felt certain that this would be the other bird. Naturalists who have repeatedly observed the bird's nesting habits, and have gone to the length of killing brooding doves to prove their point, maintain that the female of the species cares for the young during the early morning, late afternoon, and night, whereas the male takes over during midday. But again it was the same bird. We called the dove "she," because it displayed such outstanding maternal characteristics, but to this day we are not certain it was not the male.

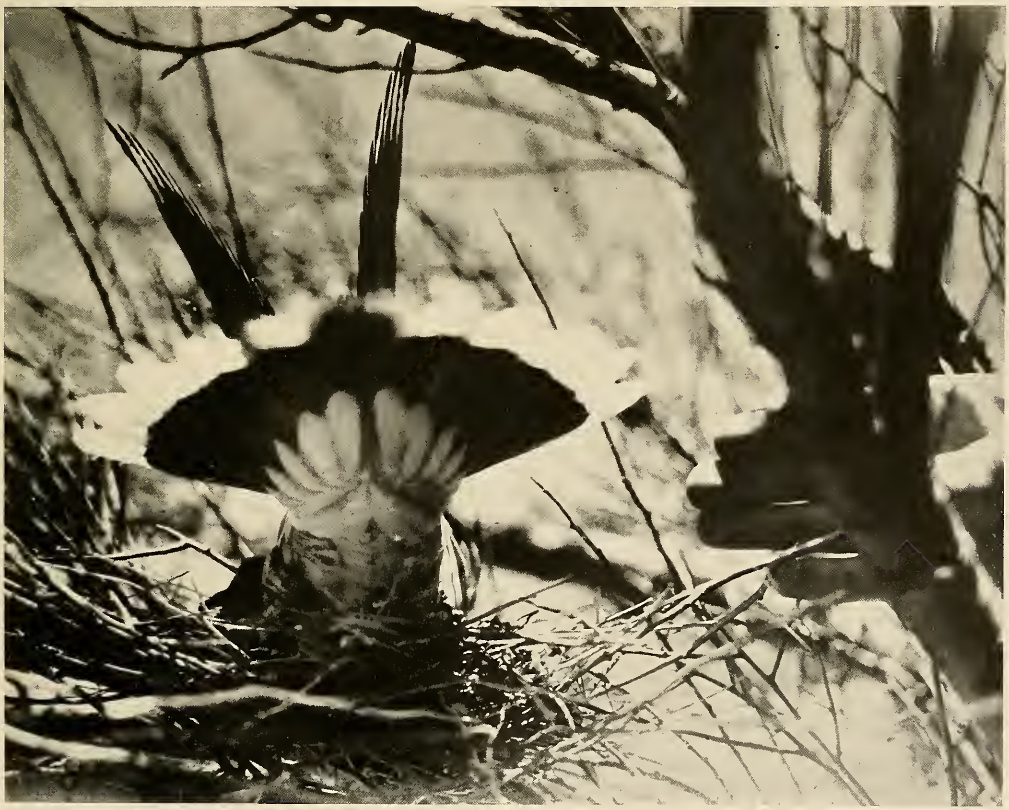
We gleaned additional information from the other nest, out in the cholla cactus. Frost and I visted the nest as frequently as we could, and one day we had the luck to see *both* parents at home at once. One bird was brooding characteristically, and the other was half-reclining upon the nest edge, its breast feathers touching the back of the sitting bird. It almost seemed that one dove was attempting to shelter the other from the intense sunlight. When the birds flushed at our approach, we found a tiny infant that had just hatched. The newly broken egg lay beside one that had not yet been opened. The very small dove clutched the nest side, actually some distance from the bottom of the shallow receptacle. Its miniature feet were attached to the twigs with surprising strength for a newcomer into the world.

The blind mite was amazingly active. It struggled upward with somewhat the same erratic motions that one associates with a little bird straining to free itself from the egg. Its head tossed from side to side, rather violently, as it progressed. Perhaps it had not yet been thoroughly "convinced" that its freedom had been gained! Very gently I disengaged its toes and placed it down in the nest. Could it be that some birds, struggling to emerge from eggs, find their release quickly and with comparative ease and employ the remaining "unused escape energy," unwittingly, to clamber up and out of the nest? Possibly the wind is not responsible for blowing as many newly hatched young from their nests as is supposed. Certainly our dove seemed bent on self-destruction. Its feet were capable of grasping and holding onto the twigs with firmness, to say the least. Per-

▲ THE WHITE-WINGED DOVE NEST. So well was this platform concealed from the ground that if the parent had not flown off, it would never have been discovered

▲ JUNIOR'S BRIGHT EYE peers from beneath its parent's wing as both birds survey the photographer

▼ EVEN when the ladder was brought within three feet of the nest the dove did not move. But if a hand were offered, she would strike it violently with her wing. In this picture her wings are poised to deliver a downward blow



haps the instinct that prompted the naked infant to cling to the twigs when I replaced it in the nest bottom might have saved it from falling when the edge had been reached! Who knows!

As for the adults: whether the second bird was standing by, to protect the young one while its mate continued to sit upon the unhatched egg; whether it was there to attend the delivery of its offspring; or whether the entire incident was mere happenstance, I truly do not know. It is often far too easy and too dangerous to interpret certain behavior in nature by assigning motives to the performers. Only too often speculations may be idle, but they are food for thought anyway. Sometimes they produce worthy results, especially if repeated observations bear out one's conclusions.

Mr. Frost returned to the cholla nest the following day only to discover that the second egg had barely hatched and that both parents were present as before. They left as he approached. While he watched, the "mother" returned and flew off again for a distance of about 75 feet, to drop the broken egg shells, making two trips to accomplish this. The actions of the parents at the nest practically duplicated those of the previous day. The newly arrived dove clung to the side of the nest too, not upon the bottom, and to use Frost's words, "It gave a bad beating to the empty egg shells, kicking them all over the place!"

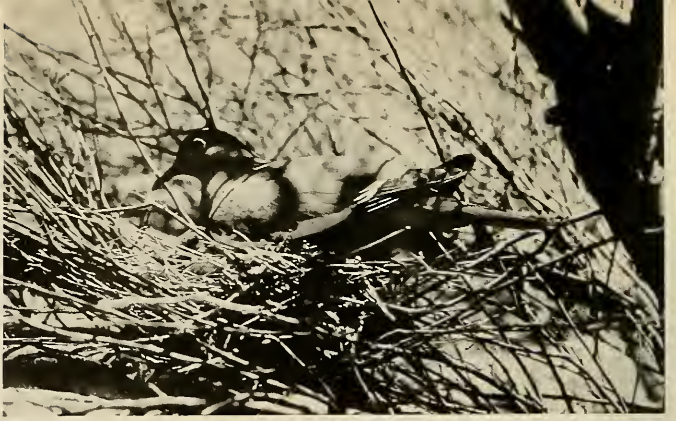
A week passed before we were able to visit the Lazy Three Ranch again. This time "Liza" was firmly ensconced upon the nest and the young bird had grown apace. The wing and tail feathers of the youngster were revealed in color and pattern. Early adolescence was in full swing. "Junior" was much more active than formerly and observed our approach from the protection of the mother's wing. We could not learn whether the other egg was present or whether a very small dove had recently emerged and was completely hidden by the older bird's body.

We moved the ladder even closer to the nest, and the patient Mr. Frost mounted it in his very best slow-motion style, barely moving as he inched his way upward until he was in the proper position and his camera was some three feet from the subject. The parent watched him curiously but did not seem overly alarmed. The little dove showed interest in the proceedings too, and looked at the strange apparition with no particular excitement.

Several exposures were made, then we decided to encourage the mother to vacate the nest for a time so that the little one could have its portrait made. To accomplish this we obtained a taller ladder and placed it carefully against the paloverde, very close to the nest. We also wanted to learn what had happened to the other egg, photographed on our first visit.

Though the ladder was only three feet away, the dove did not depart. She merely turned about, the better to watch us. I climbed the ladder and still there was no particular action in the nest. Then Mr. Frost climbed up and once more brought his camera into play. Quickly he secured several more pictures of the parent, expecting her to fly at any moment. Finally he extended his hand toward the White-wing, positive that she would leave. To his surprise, which was so great that he almost fell off the ladder, camera and all, the mother suddenly raised her wings and struck his hand with all the strength she could command. While the blow, in itself, was not painful, the effect of the unexpected action was decidedly startling.

Here was a real exhibition of parental defense. "Liza" simply would not leave! Later I gently tried to lift the bird with a small stick. She merely repeated the wing-striking and



▲ **With every feather** in place and white showing along the wings, the faithful dove shelters her young from the desert sun

▲ **"Junior"** in pinfeathers, photographed during one of the rare moments when the parent bird was away. The other egg vanished moved about the nest to avoid the stick. The baby, in the meantime, climbed out on a convenient branch far enough to avoid the defensive operations carried on so strenuously in its behalf. There it stood, teetering back and forth, appearing very much disturbed and woebegone. We discovered that the other egg was no longer in the nest. What had happened to it, or to the cowbird egg, we never did know.

We desisted and retired to the ground to discuss further strategy. We did not want to lift the dove bodily from her position, so we decided to try to obtain a photographic record of the mother's behavior. One of us climbed the ladder while the other manipulated the camera from an adjacent stepladder. Once more the mother beat the offending hand as the shutter clicked. While she was engaged in her courageous campaign, she spread her tail, fanwise, and fluffed her feathers generally so that she appeared much larger. We had observed this procedure in many birds, particularly the Great-horned Owl, which "swells" enormously when excited.

My point of observation was so close that I was actually touched by the bird and was able to examine her minutely. When her slightly rounded, white-tipped tail was spread, several brownish feathers were revealed in the center. An exquisitely colored bright bluish patch surrounded each eye. When the desert wind ruffed the sitting bird's feathers she would close her eyes momentarily and we could see that the eyelids were bluish too. The pupil of the eye itself was black, encircled with a ring of orange red. A suffusion of greenish iridescence upon the neck shaded into the soft grayish back. There was a short black line on either side of her throat. When the wings were folded, one could see a white edge. When viewed from a distance, especially against the sun, a great deal of this detail was naturally lost. When our observations were concluded, we left the birds to themselves, never to disturb them again.

One morning, several days after we had left, the ranch proprietress went out to feed her turkeys and discovered that the White-wing nest was empty. No doubt a young dove was flying among the cactus giants, not far off in the desert, learning the art of perching upon the spines that guard the tips of the saguaros. Possibly its mother or father, or both birds, accompanied it. In any event our adventure with the doves was at an end, and the very last connection we had with the entire incident was when we drove past the Lazy Three Ranch some weeks later and saw the same little black colt following his mother through the cholla cactus, this time without any spines in his nose.

▼ ANOTHER DESERT WHITE-WING NEST was discovered in this chollo cactus plant, well fortified with spines against marauders. The bird was on the nest when this photograph was taken

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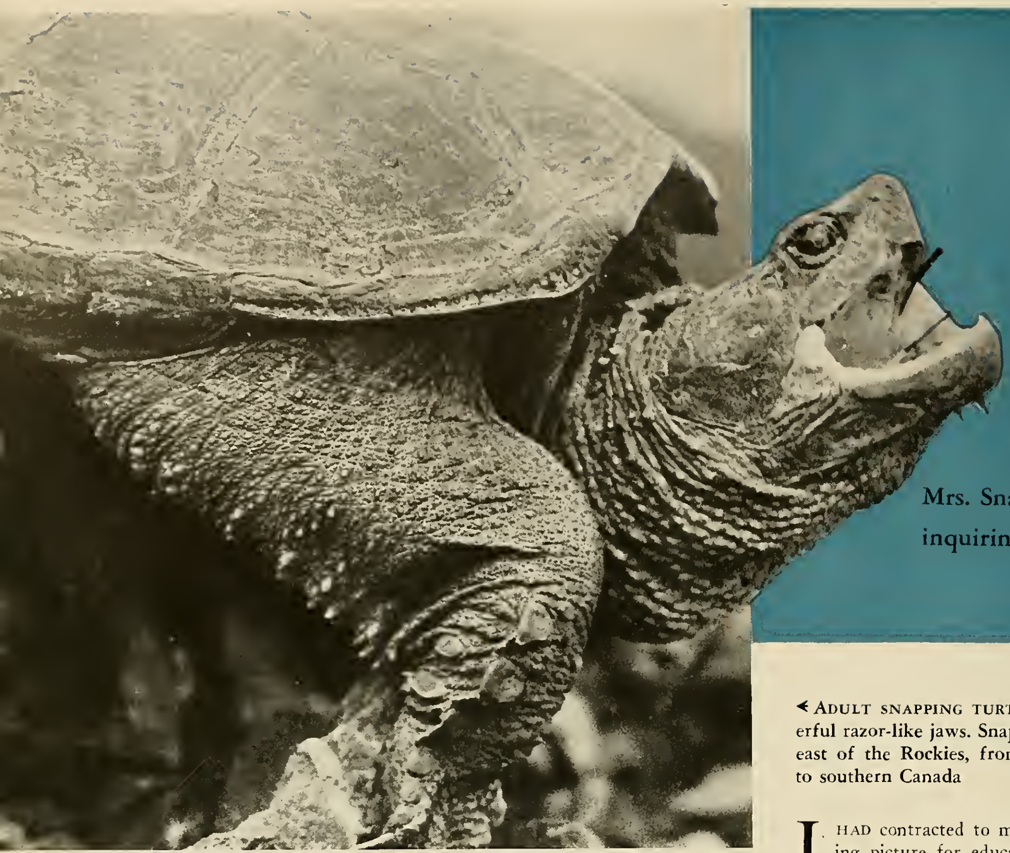
Mrs. Snapper's habit is
inquiring photograph



< **Adult snapping turtle**, showing the po
erful razor-like jaws. Snapping turtles are fou
east of the Rockies, from the Gulf of Mex
to southern Canada

▼ **Close-up** of the tail

I had contracted to make a moving picture for educational purposes on the life story of the Snapping Turtle. It is one thing to take a snapper's portrait and quite another to show its life cycle. Having had quite a few years' experience with creatures of the fields and woods, I knew what happens in the life of the snapping turtle; but matching one's wits with these creatures and being at the spot when some of its most important duties are performed is something that takes planning. Then too, there were lighting problems. If and when these activities occurred, how could I tell whether the lighting would be suitable for camera work?

I set to thinking about how all this could be accomplished in a setting that would be right for good photography. I came to the conclusion that the first thing necessary was a pond with authentic surroundings in a spot where sunlight would be available from early morning until late in the afternoon. In such a setting I would have my subjects where I could study them. The only solution was to have a pond constructed on my premises.

RTILE
RTLE

By LYNWOOD CHACE

Photographs by the author

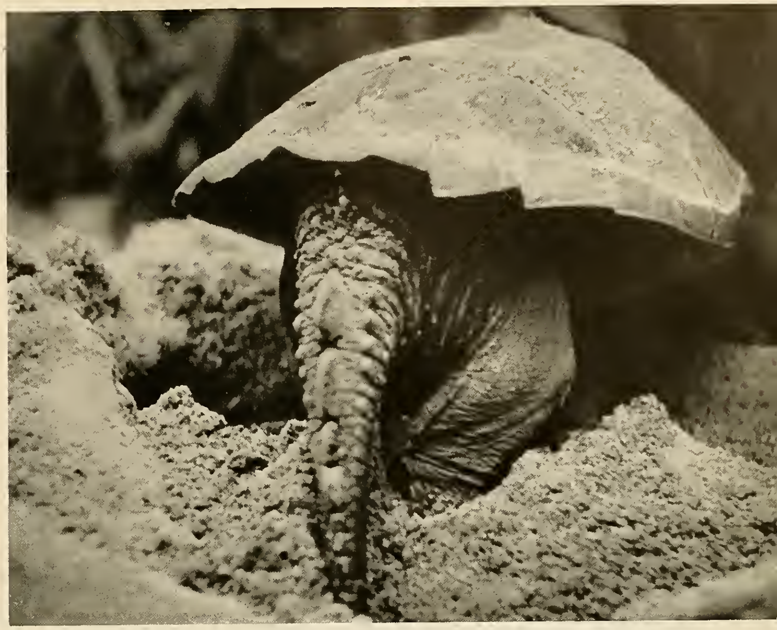
ry her 20 to 30 eggs, but the
ted to see what was going on

So I secured the services of a contractor and constructed a pool 20 feet wide by 40 feet long.

When the pond was completed, I went into the swamps, collected water plants, and planted them in and around the pool. All this was not done in one day. Many trips to swampland had to be made before the setting was properly arranged. At one end of the pond I made a sandy beach where Mrs. Snapping Turtle could lay her eggs, because that was the sort of spot she would want. After working strenuously for about a week I had my pond ready for occupancy.

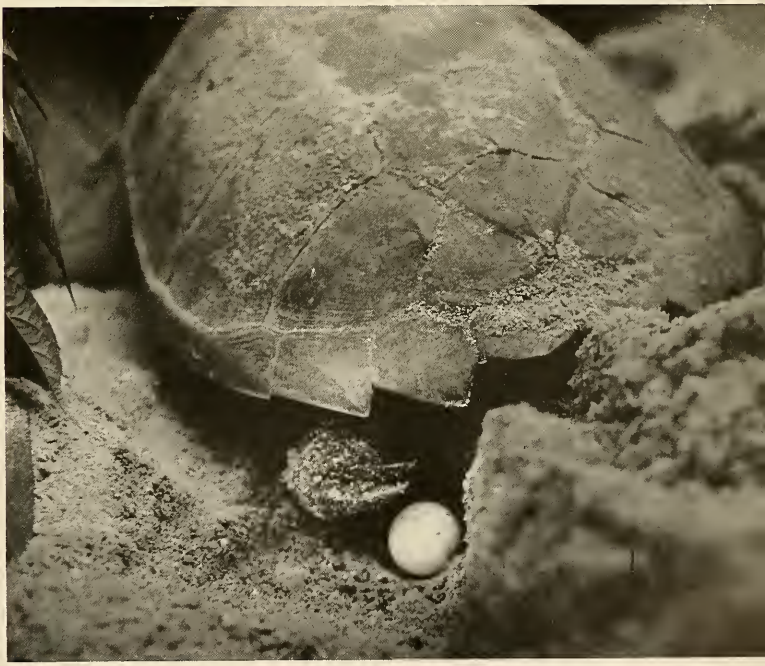
The next thing on the program was the actors. I hadn't the time to go hunting them myself, so I inserted an advertisement in our local newspaper and also in the news broadcast on the radio, stating that I wanted some snapping turtles and also the eggs. This worked out very well, for within three days I began to get results and in two weeks I had fifteen specimens in my pond and 84 snapping turtle eggs. I buried the turtle eggs in a sand pile I had carted to my premises.

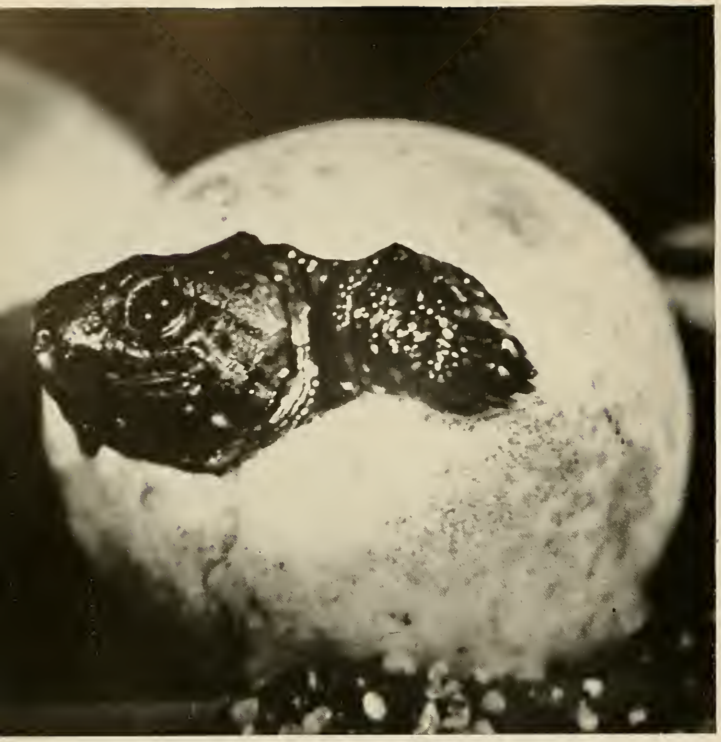
One of the shots I was planning to get was of the baby turtles in the process of hatching from the eggs. I knew it took three months for turtle eggs to hatch, but I wanted to know



▲ MOTHER TURTLE preparing to lay her eggs. She digs a hole in the sand with her hind feet and covers the eggs. The sun incubates them

▼ SHE deposits the eggs at the rate of about one a minute, until 20 to 30 are laid. Here the sand has been scooped away to give a better view. The young turtles hatch in about three months, but the author had to build a plate glass window into the ground so he could see when to get his photographic equipment ready for the event





▲ EXTREME CLOSE-UP of the first stage of hatching. The baby turtle has pierced the shell with its head and one foot

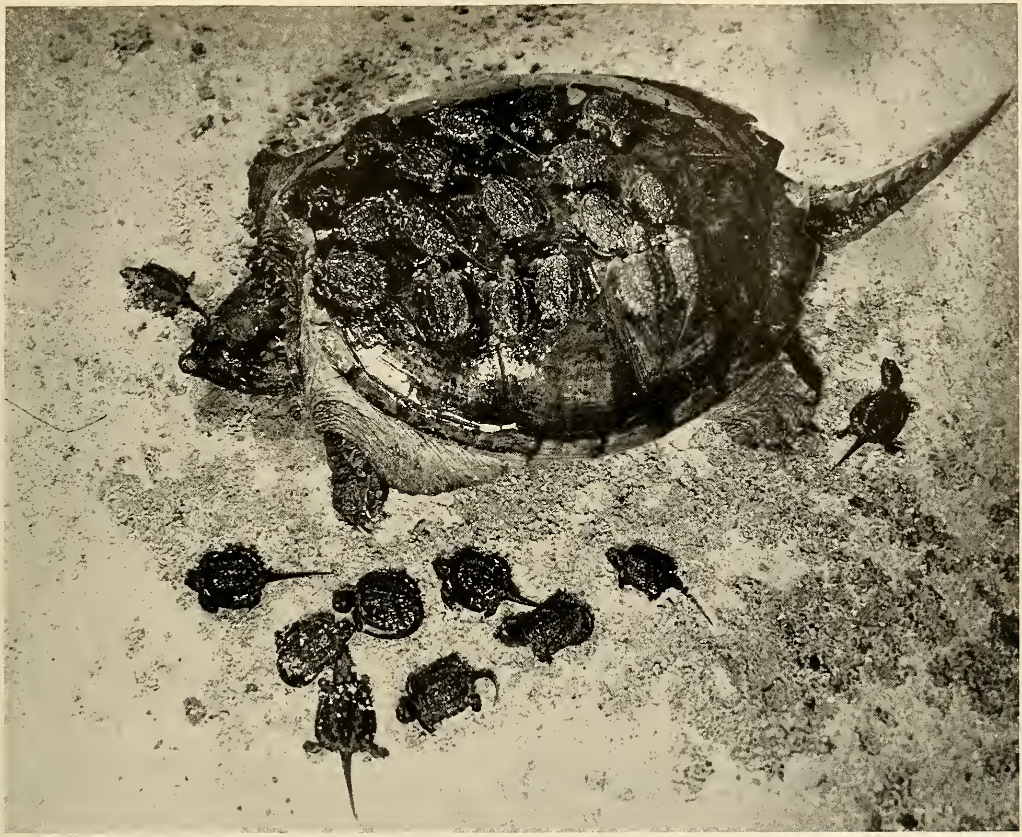
▼ "EVERYBODY'S DOING IT": a half-dozen young snappers taking their first look at the world

the exact minute when this was going to happen. The only way to be certain was to have some way of checking on the turtle eggs, yet it would not do to interfere in any way with the process of incubation. So I placed a piece of plate glass upright in a hole dug in the sand, and put the turtle eggs in the hole down one side of the glass and covered them. Then I scraped the sand away from the back side of the glass. In this way I could see what was happening to the eggs at any time. The arrangement was entirely successful, and I was able to photograph the whole process of hatching.

Then came a much more difficult problem; getting the sequence of Mrs. Snapping Turtle in the act of laying her eggs. I had fifteen snapping turtles in the pond; and the special sand beach was just right for a turtle inclined to lay eggs. But when would this happen? It was just a matter of patiently waiting and hoping that a turtle would crawl out of the pond one day and put on her act. Two months passed and nothing happened, and the constant vigil was beginning to tell on my partner and me. One evening we were busily engaged in drilling a hole in the concrete floor of the pond to insert a sub-pump so that we would be able to drain the pond, because the water had to be changed at times. The pond was empty of water at the time, and the turtles were all up on the embankment walking about. My partner had just started off to get a drill when he noticed a snapping turtle digging about in the sand. On further examination we soon came to the conclusion "this was it."

We certainly were caught off-guard. All the photographic equipment had to be brought to the scene and set up. It was about 8 P.M., and darkness was falling so rapidly that artificial lighting would have to be used. I have never worked as fast as I did that evening. The turtle, by now, was making great progress with the hole in which to lay her eggs, and our whole aim was to get shots of the entire procedure.

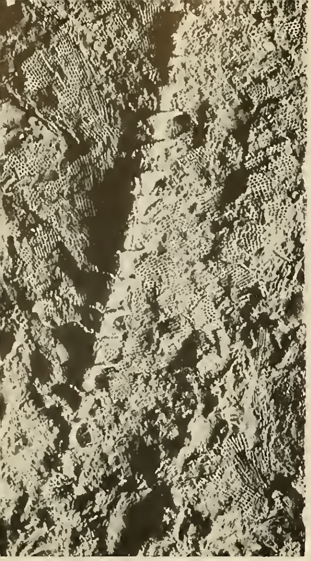
I rushed into the basement of the house to connect a 100-foot extension cable and run it out to the pond. Wire fencing enclosed the pond, and this had to be cut with wire clippers in order that the camera and equipment could be brought close enough to the spot Madam Turtle had chosen. After the fencing had been cut,



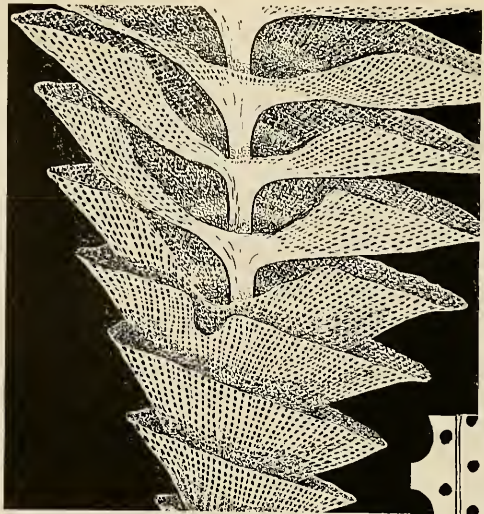
⮝ TWO-DAY-OLD SNAPPERS are small compared with the bulky adult. The snapping turtle does not mother its young. The baby turtle must face life alone from the time it hatches

⮜ YOUNG SNAPPERS swimming under water, where they will secure much of their food. If very lucky, they may grow into huge two-footers

in the greatest haste, I began setting up the lights. At the same time my partner, with all speed possible, was loading the film magazine. When all the equipment was set to go, I jumped to the camera and began focusing, fearing that the turtle might become discouraged at any moment with all this interference of her domestic duties. However, I began shooting, and once under way, nothing seemed to change her plans. She went right ahead and laid her eggs as though it were specially for us. So we succeeded in photographing the whole process.



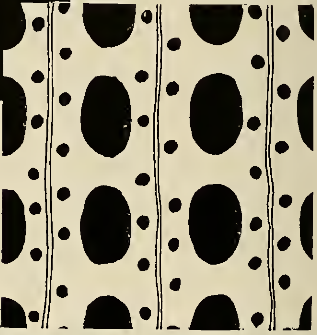
▲ THE *Archimedes* SPECIMEN, seen *below* through the lens, slightly enlarged, with frond almost entirely preserved, though crushed. Its details are well recognizable



Drawings by Paula Hutchison

◄PARTIAL RECONSTRUCTION, about three times enlarged, of an *Archimedes,* with part of the frond broken away to show the "screw." Both obverse (inner) and reverse (outer) sides of frond are visible

▼ DETAIL (enlarged about 30 times) of obverse side of frond. Large holes are fenestrules ("little windows"); small pores on vertical branches (marked by keels) lead to cells which house individual zooids



A Sample of Sea Floor of 260 Million Years Ago

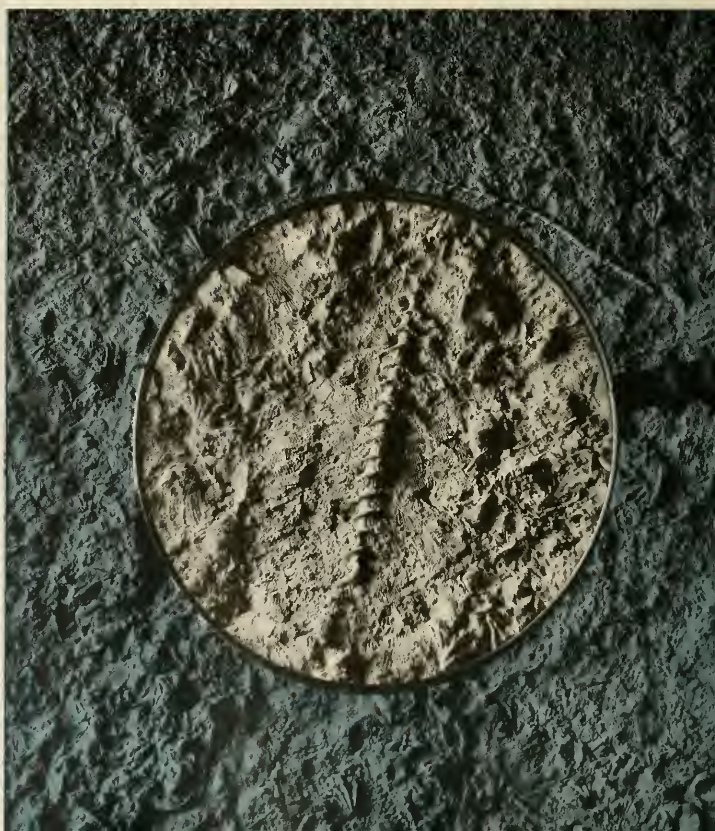
By OTTO HAAS

Associate Curator of Invertebrate Paleontology, The American Museum of Natural History

THE slab of rock shown on these pages, four feet five inches long and three feet seven and a half inches wide, is now being prepared for exhibition in the American Museum's Hall of Geology and Invertebrate Paleontology. On arrival at the Museum it weighed more than a ton and a half; for reasons of safety its weight had to be reduced by halving its thickness.

This slab, which the writer collected about a year ago near Crane, Indiana,* consists of Glen Dean limestone, one of the rock formations of the Chester series. Its surface is covered throughout with the hard parts of almost 50 different kinds of animals that inhabited the sea of the Mississippian period which, about 260 million years ago, deposited the Glen Dean limestone. Thus, the slab presents an almost complete picture of the animal life of that sea.

The total number of animals pre-



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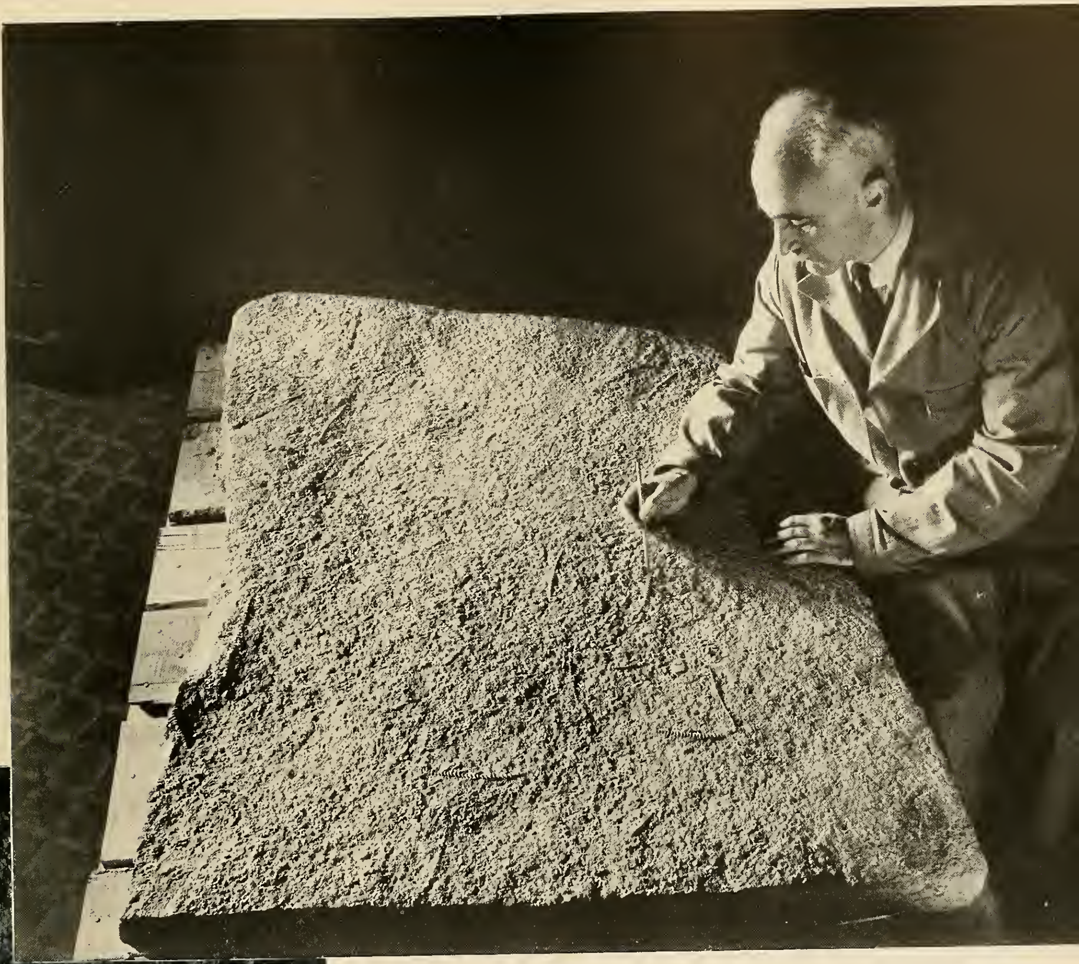
*The story of its discovery, recovery, and shipment to the Museum is attractively told, in a fairy tale fashion, by Mrs. Jane Capen Dale in the article "*Archimedes* and I," published in the current issue of *Junior Natural History.*



< **Part of slab,** showing the same *Archimedes* surrounded by many fossils of various kinds

▲ **Whole slab,** with the writer pointing to the specimen whose frond was so unusually well preserved

served on the surface of this slab, not-counting many more within the rock, may be estimated conservatively at several thousand, if the colonies of bryozoans or moss animals, which predominate among them, are counted as individuals. However, each of these colonies includes tens of thousands of cells, or zooecia, which, as long as the colony lived, were inhabited by a zooid each. If the zooids were counted as individuals, a total of many millions of animals would be readily reached.

Most conspicuous among all the fossils contained in this rock are the spirally coiled "screws" which supported the delicate, lacelike skeletons of certain moss animals (bryozoans). Science named them *Archimedes* after the famous Greek philosopher and scientist who lived between about 287 B.C. and 212 B.C., because they exhibit the spiral curve that also is known under his name. To some of these screws the meshwork of the skeleton, called the "frond," is still attached; its structure is illustrated and explained opposite. Many other bryozoans, brachiopods (lamp shells), gastropods (snails), and a few representatives of other groups of marine invertebrates ("backboneless" animals of the sea) round off this picture of teeming life of long bygone days in the earth's history.

A.M.N.H. photos

The Naturalist on a "BUSMAN'S HOLIDAY"

By DILLON RIPLEY

Ardent collectors on service in far corners of the world have found time to pursue their scientific hobbies, and museum collections have continued to grow despite international unrest

NOBODY can prevent a sailor on furlough from taking a rowboat out on Central Park lake. Apparently it was almost as hard to stop a naturalist or a museum man from indulging his profession wherever the war happened to carry him.

A well-known student of birds from Cape Cod was a Navy officer on a small vessel carrying cargo and munitions in the Bismarck Sea. Taking advantage of a brief stop at one remote island after another, he managed to make a valuable collection of bird specimens from the Solomons. His collecting equipment was crude enough. One look at it, and the average meticulous scientist of peacetime would have thrown up the sponge. His only weapon was a twelve-gauge sawed-off shotgun, known as a riot gun; his ammunition, slugs or buckshot. And yet with this assortment of firepower he secured a couple of hundred specimens of great value to museum research. Some of his specimens, believe it or not, are the size of our local warblers and sparrows.

In the last year or so museums all over America began to receive packages from servicemen in far places. Some of the names on the boxes of specimens are those of well-known museum collectors of peaceful times. Others are of enthusiastic amateurs. Some of the collections run to hundreds of specimens. Others are small boxes with a handful of birds or a single tin of fish or shells. But all are welcome and are gratefully received by the biggest museums in the country.

Most of the specimens had blank labels tied to them with numbers but no localities. Censorship had seen to that. The collector could carry a notebook with names, numbers, places, and other information important to the scientist, but he couldn't mail it home.

The complications of collecting in wartime were many and varied. The average serviceman didn't have much time to go around poking through the bushes looking for specimens. It's not even an easy way to relax. But it is educational and offers enormous diversion from the ordinary routine of life in camp or aboard ship. The easiest collecting I know of was done by a friend of mine, a well-known expert on snakes from Kansas. He was stationed somewhere in India. Every day the camp area was policed, and the chances were very good that someone would find a snake. At first the GI's used to shoot them full of holes, but later they brought them back to "Doc," who carefully put them into old tin cereal containers filled with preservatives. So far he has collected about 23 species ranging from cobras and Russell's vipers to harmless rat snakes. It's as easy as the proverbial rolling off a log.

One of the largest collectors in this war was the United States Government. The Army and Navy sent out a number of museum specialists to the jungles of the South Pacific. It was the job of these men to study small tropical forest mammals, rats, squirrels, shrews, or marsupial forms, like miniature kangaroos and opossums. Many of these animals may be carriers of fleas or ticks bearing deadly diseases such as spotted fever. By studying the occurrence of these diseases, lives of servicemen could be saved on the jungle battlefronts. Specimens of these animals and often of birds as well were collected and sent back to Washington to the Navy or Army Medical collections, from which they were finally transferred and deposited in the United States National Museum.

Collectors sometimes have to be ingenious. One Army officer on a mission in the Himalaya mountains walked through southern Tibet and western China. Birds are scarce at high altitudes. Above 11,000 feet the few patches of trees and gardens where they would be found are mostly close to the Buddhist monasteries. But the Lama priests are very strict about killing animals, and guns are forbidden. My friend met a British government agent who taught him how to use a slingshot, "firing from the hip" so that the Lamas wouldn't notice. He finally managed to get a round dozen of specimens,

Continued on page 436

Drawing by Felicien Philippe

"Now I've seen *everything*!"

People of the Past

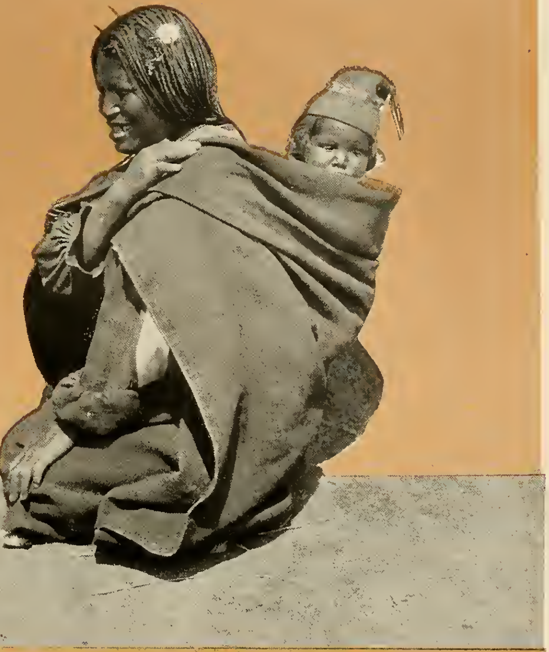
By ALFRED MÉTRAUX

Bureau of American Ethnology, Smithsonian Institution, Washington, D. C.

On a barren and desolate plateau in the heart of South America live the Chipaya Indians, a carry-over from the days of the Incas, untouched

All photographs by the author

↙ MOTHER AND CHILD. The hair of the Chipaya woman is dressed like that of the mummies. Notice the large silver pin, or "topu," in her hair

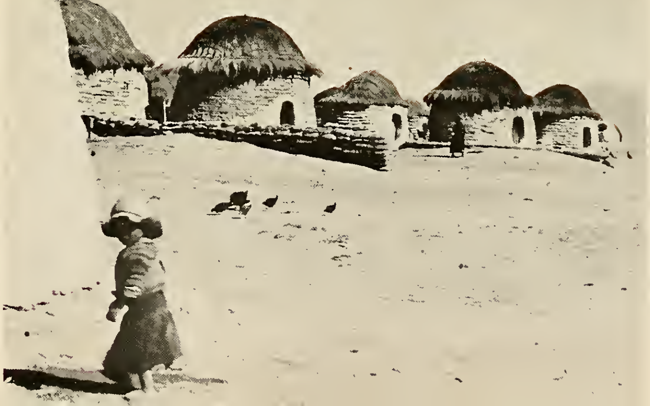


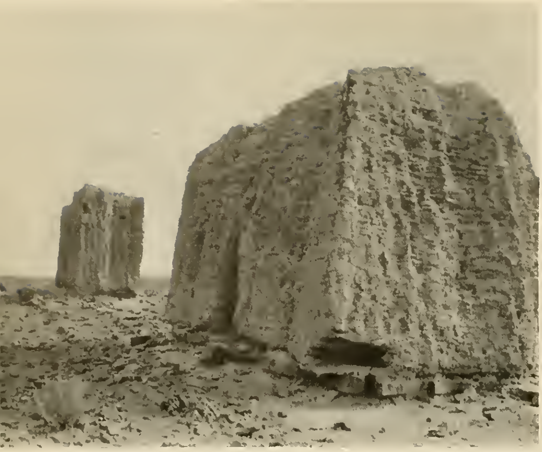
THOSE who have journeyed across the highlands of Bolivia, south of Lake Titicaca, can never forget the strange "villages" that loom over the horizon along their road, either perched on mountainous slopes or scattered along barren plains. The modern Indians avoid these places, and, if forced by necessity to approach them, they never fail to recite a prayer or to present as an offering their *acullico*, a quid of coca leaves taken from their mouth.

Seen from a distance, the structures are not terrifying. They are small, square towers with low doors, invariably turned to face the rising sun, and their construction shows the care of men who have worked long and hard. Age has left the towers intact, and though made of adobe, they appear neat and clean. Were they not so geometrical, a casual observer might confuse them with huge termite hills.

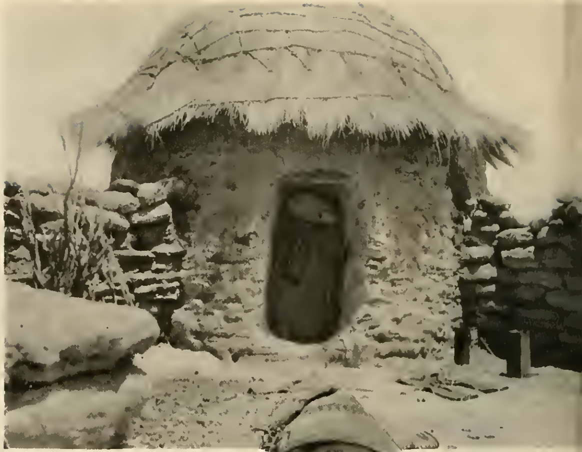
The industrious, stern-faced people who built these structures are still there, wrapped in heavy woolen garments and huddled in the grim chambers, as if driven there by a sudden storm. But they are silent, for they are only *chullpas*—the dried mummified remains of the folk who once owned the land.

▼ IN THIS VILLAGE, situated south of Lake Titicaca in the highlands of Bolivia, live the Chipaya Indians, descendants of the ancient Collas. Their claim to distinction lies in the fact that they are the only living people who can give us an idea of rural life at the time of the great Inca empire

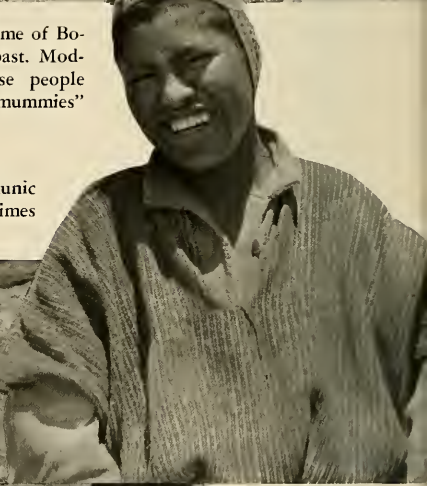




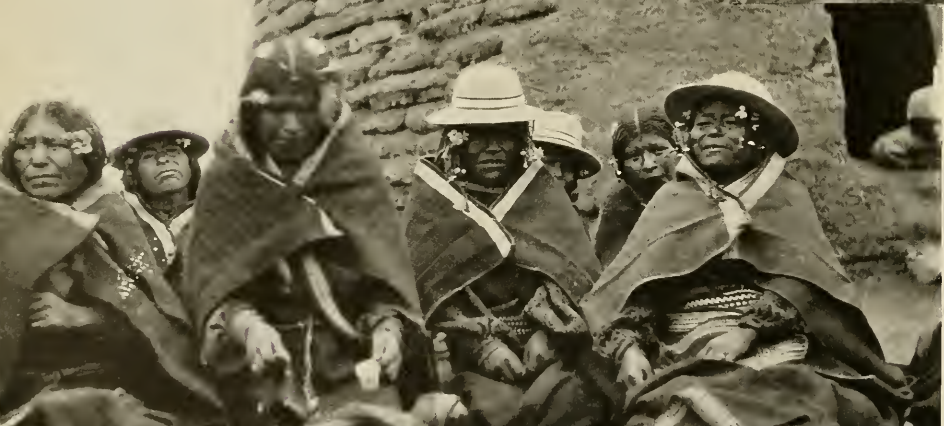
▲ A CORNER of a "ghost" village. Modern Indians try to avoid these towers, because they contain the dried, mummified remains of the people who once owned the land



➚ A CHIPAYA HUT, home of Bolivia's people of the past. Modern Indians call these people "the leftovers of the mummies"



➤ THIS CHIPAYA BOY'S woolen bonnet and woolen tunic are typical of garments worn in pre-Hispanic times



◄ EVEN the gestures remain unchanged. Before she drinks, the woman spills part of the contents of the cup on the ground in honor of the gods

These people were the ancient Collas or Aymaras, whose descendants form the bulk of Bolivia's population. Modern Indians, however, deny any relationship with the "gentiles" clustered in these burial places, for they believe the chullpas were heathens who were banished from life by a divine curse. Strange legends circulate about them. It is rumored that the "antiguos" (the ancient ones) had fabulous treasure hidden somewhere in the crevices of the mountains. But few are those who succeed in gaining access to it. The dead "gentiles" are dangerously vindictive and always ready to inflict misfortune on the poor Indians.

To the Aymara Indians of the region of Carangas and of the Poopó, the race of the "gentiles" is not entirely extinct. They know that in the south of the Department, near the Salinas of Coipasa, there is still a village inhabited by their descendants. They call them *chullpa puchu*, "the leftovers of the mummies." These living mummies are not a mythical people; they are the isolated Uro-Chipaya whom I studied during two anthropological expeditions in 1932 and 1939. They are the last representatives of a primitive people who occupied large areas of the Bolivian Highland in remote ages, but who were already on the decline when the Spaniards arrived. The conquistadores heard strange stories about them: they were reputed to be so primitive and so filthy that the Inca, unable to obtain any tribute from them, had ordered them to bring every year to the Cuzco, tubes filled with their own lice. They lived mainly around Titicaca, subsisting on fishing and building the reed balsas on rafts which have become so famous.

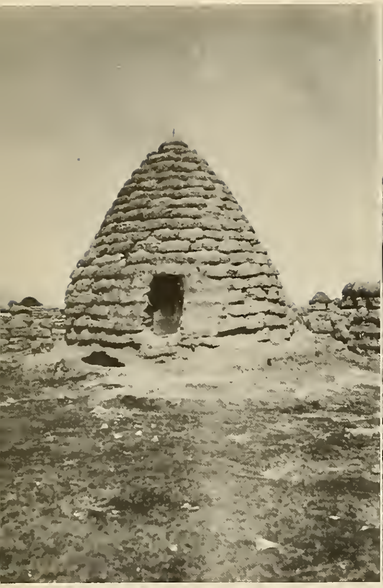
Today, the last Uro are a handful in the village of Ancoaqui, near the mouth of the Desaguadero. The Chipaya are another group of Uro that had remained unknown until Max Uhle mentioned their existence toward the end of the last century. The first scientist to visit them was Dr. Posnansky of La Paz. He brought back from this trip a short vocabulary which proved beyond doubt that the Chipaya were closely related to the Uro of Ancoaqui. Dr. Rivet of Paris attempted to demonstrate that their language was related to the Arawakan dialects of the tropical lowlands and that the Uro were perhaps the remnants of an old population that had come from the eastern forest and occupied the valleys and plateaus of the Andes.

The poor Chipaya themselves admit that they occupy a strange position in the world. They readily recognize the differences between themselves and the Aymara Indians of the region, and they comprehend that they share some common heritage with the grinning "mummies" they have glimpsed in the darkness of the adobe chullpas. They explain their presence in the deserts by a myth, which I shall summarize: "Long ago, the sun would rise in the west. Man said: 'We shall put the doors of our houses in the east.' As soon as they had uttered this wish, the sun altered its course and rose in the east. All the men, women, and children died in the huts. They are the present-day chullpas. But one man and one woman escaped by diving into a river. They went downstream walking under water. Finally they arrived at a barren and desolate plain, where they built a village. They labored at night as other people work by day. At length they were discovered by an Aymara Indian, who summoned a priest. The latter came and sprinkled the village with holy water. The spell was shattered and the children of darkness once more could enjoy the beauty of light and the warmth of the sun. Now these people live as everybody does, but being the children of the dead, they wear the costume of the chullpas and still put the doors of their huts toward the east. The language they speak is the same as the one used by the 'gentiles.' "

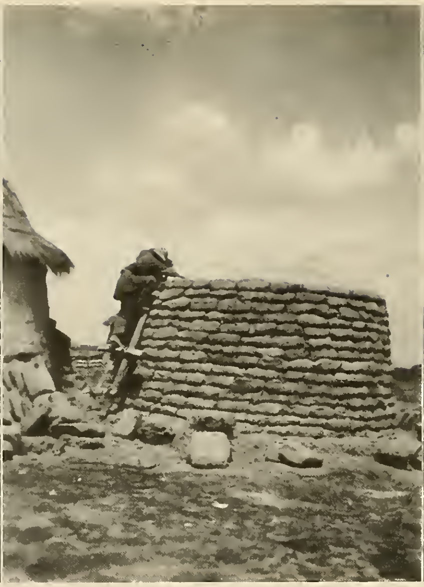
"The barren and desolate plain on which we live . . ." I still remember the bitterness with which this phrase was uttered by one of my informants. I know of no other region that causes such an overwhelming impression of isolation and emptiness. A flat immensity, patched by white saline deposits, is dominated by unnamed mountains towering over the 12,000-foot plateau. Life here is brutally harsh. One awakens in the morning with limbs numbed by cold and heart

▼ **An artificial flood** is created by the people during the rainy season when the river is high. This fertilizes the barren and desolate plain and enables the people to maintain their meagre pastures

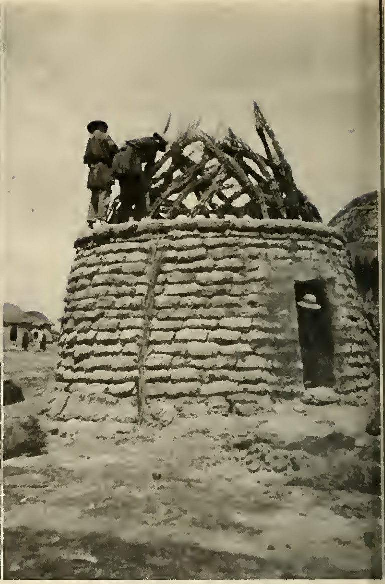
▼ **Llamas** pasturing near Chipaya village. The people also raise sheep and pigs



▲ "Necessity is the mother of invention." There is not a single tree, not even a cactus, from which to construct a house, and the soil is unsuitable for making sun-dried brick, so the Chipaya make huts of sods cut from the marshy ground

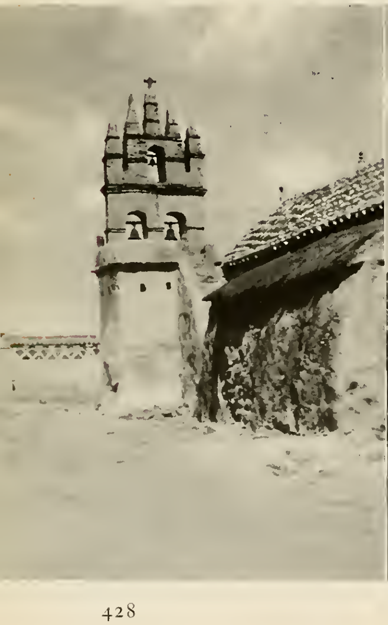


▲ Building the house. The Indians heap the sods to form round huts somewhat like Eskimo snowhouses though structurally different

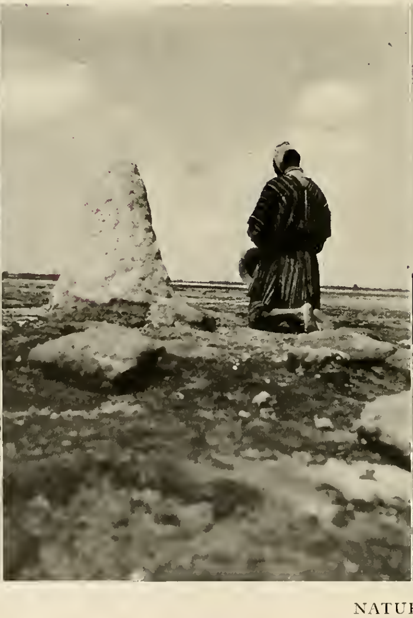


▲ The sod walls of the houses sometimes have thatched roofs made of arched bundles of tola, a shrub that grows on the highlands

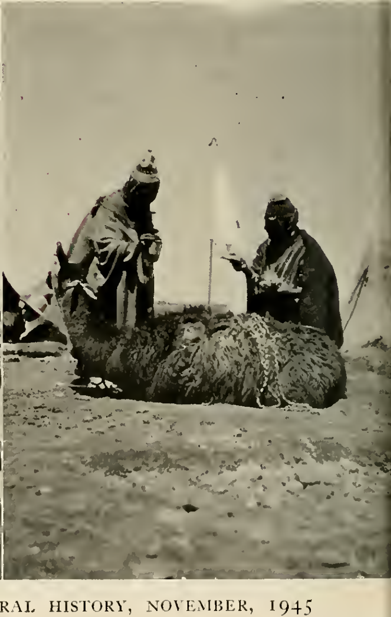
▼ Chipaya religion is a blend of old Andean beliefs and rites with some Catholic practices. The tower of their church is worshipped as a powerful fetish



▼ The Chipaya worship a host of spirits, or *mallkus*, represented by cones of sod built on low platforms in isolated spots about ten miles from the village



▼ Consecration of a llama before sacrifi
The animal is decorated with woolen tuf
exposed to the smoke of incense, sprinkl
with alcohol, and covered with coca leav



oppressed by the thin atmosphere. Only at noon, when the sun burns intensely and one dozes lazily against the wall of a hut, does one feel rid of the night's spell. On these highlands a feeling of emptiness seizes the mind, and wherever the eyes turn they are caught by a gray expanse, relieved only by the ardent blue of a midday sky. Grimmest of all is the great silence, an iced, unearthly stillness which is never interrupted and to which one can never become quite accustomed. It is a silence unbroken by human voice, or even by the remote cry of a bird or animal.

Here, in the midst of a cursed country, the Chipaya have their village. They are as isolated on their desert plain as natives on an island surrounded by a vast sea. Not one segment of their history is known. Their position in these dreary surroundings speaks, however, of their struggles against the warlike Aymara, who must have driven them into this desert abode. To this lost village of the desert has been given, by an irony of fate, the curious destiny of perpetuating down to our times, the architecture, dress, social organization, and religious beliefs of the people of the Inca empire, four centuries after the disappearance of that civilization. For the Chipaya have preserved far better than the Aymara the traditions of the past, both in material and spiritual culture.

I arrived at Chipaya late on the eve of New Year in 1932. The mirage this day was playing all sorts of tricks on us: at times full lakes were formed and disappeared, towns sprouted like plants above the horizon, llamas were changed to colossal camels. We advanced across the plain, guided only by the spire of a church. Coming suddenly upon the village, we discovered that the Chipaya were celebrating a feast, and our arrival was totally unexpected. Yet, no surprise was shown. The calm of the highland was not disturbed by the trifle of our presence. I entered the hut of the chief, to find myself surrounded by a group of ghostlike men. They exchanged few words and remained perfectly immobile, squatting on the ground.

A single glance about the hut was sufficient to solve many minor problems of Andean archaeology. The hair of the Chipaya women was dressed like that of the mummies we had seen. The brown robes and the white and black belts were identical to those we had exhumed just a few days earlier in some chullpas of the region of Huachacalla. Even the folded cloth worn by the women on their heads had been depicted on Inca pottery. Miniature bronze idols jingled in their braided hair. These were antiques that the Chipaya had adapted to their own use and were exactly like those discovered in the ruins of Tiahuanaco, the mysterious city of the Titicaca, which was already a heap of ruins when Columbus discovered America.

Indeed, all the objects about me seemed to have been rescued from the archaeological past. Even the gestures remained unchanged; the chicha, or maize beer, was served in two cups as it used to be among the Inca. This custom was explained by a Spanish chronicler: "It was politeness and courtesy at the court of the Emperor to present the guest with two cups, one of which he offered to whom he wished." Then, as now, part of the content was spilled on the ground in honor of the gods.

The Chipaya managed to survive in their inhospitable homeland by a prodigy of work and skill. They dug across the plains an intricate system of small canals, which drain the waters of the Rio Llauca, west of their territory. In the rainy season, when the river is high, they create an artificial flood, which fertilizes the plain and allows the people to maintain their meager pastures. Thus, they raise sheep, llamas, and pigs. With the milk of the sheep they make cheese, which they trade with their neighbors for coca, alcohol, potatoes, and maize.

The problem of building a dwelling is the most difficult the Chipaya face. Nature has refused them any natural shelter and deprived them of everything that might be necessary to construct a house. On their desolate plain there is not a single tree, not even a cactus, and the soil is not suitable for making sun-dried brick. Yet here ingenuity has again overcome all obstacles. Like the Eskimos, who cut blocks of snow to make their snowhouses, the Chipaya hack large sods and heap them to form round beehive huts that have a strange likeness to the winter houses of the Arctic people. In the village, however, the sod walls of the houses have a thatched dome-shaped roof made of arched bundles of tola, a shrub that grows on the highland.

What has been called Inca communism still prevails in Chipaya. The pastures belong to all members of the two moities into which the village is divided. In the village itself the individual owns nothing except the little patch of land upon which are built his house and corral. The arid lands cultivated by the Chipaya are divided into long strips 30 feet wide and are redistributed each year among the different families.

January and February on the highlands are months of storms and rain. Swollen rivers flood the sandy plains, and the entire territory becomes a vast swamp. Grass grows taller and greener; pigs find better food in the bogs. These months can be a time of unaccustomed abundance; from them comes prosperity, existence,—or annihilation. In some years the rain is late and storms break up beyond the horizon. Then the blue sky becomes a threat and the clans feel the pangs of fear, for if the rains do not visit the Chipaya, it means death to the herd, hunger and famine for the people. In order that the waters may come to fertilize the sands, the men beseech their pagan deities and the ancestral ceremonies are celebrated once again according to rites almost as immutable as the blue Andean mountains.

Chipaya religion is a blend of old Andean beliefs and rites, with some Catholic practices intertwined. The main deities of their public cult are the Earth-Mother, who is often confused with the Virgin Mary, and a host of spirits (*mallku*) represented by cones of sod built on low platforms in isolated and secret spots about ten miles from the village. They also worship the mountains on their horizon, the Llauca River, and the tower of their church, which is a powerful fetish. The community is also under the protection of sacred stone fetishes, or *samiri*. Each household also recognizes spirits represented by stuffed wildcats or hawks.

The high point of the ceremonies observed for these deities is the sacrifice of the three animals on which the pastoral Chipaya depend for their subsistence: a llama, a sheep, and a pig. Each animal, decorated with woolen tufts, is exposed to the smoke of incense, sprinkled with alcohol and covered with coca leaves. Then the ceremony begins. The native priest, or *yatiri*, slits the throats of the animals. As the blood gushes from the arteries, it is poured into bowls con-

◂ THE PRIEST, or *yatiri,* slits the throat of the animal, pours the blood into bowls containing flour, and throws it toward the four points of the compass as an offering to the spirits

◂ CUPS containing a sacred brew are offered to the deities. It is made of maize beer, feathers, incense, copal, flowers, crystals, pulverized sweets, mineral powders, and leaves of gold and silver paper

taining flour and is thrown toward the four cardinal points of the sky, as an offering to the spirits who own the world. When the spirits of the air have received their share, the cone fetishes, or *mallku*, are smeared with blood, which in red streaks covers the dark brown stains of past rites.

No aspect of Chipaya religion is dissociated from blood sacrifice; even the Catholic crosses and the chapels are splashed with blood offered to the Saints. When a house is built, a sheep is sacrificed and its blood is sprinkled against the walls and roofs. These Indians also offer to their deities a curious beverage—a brew of maize beer, feathers, incense, copal, flowers, crystals, pulverized sweets, mineral powders, and leaves of gold and silver paper. The same mixture was spilt in honor of the God of the Inca, but instead of leaves of silver and gold paper, costly gold and silver jars were presented in days gone by. The offerings today are a shadow of the past—make-believe treasures suggesting the splendors of a vanished age.

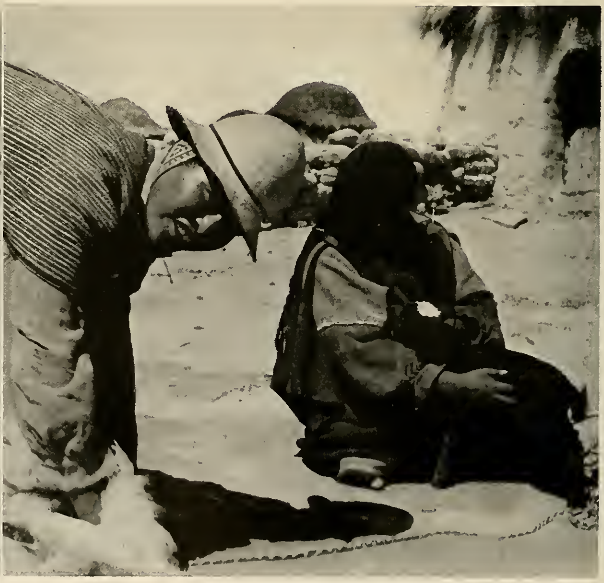
The hard struggle for life has made the Chipaya sordid and miserable, but when the blood of their herds is lavished on their deities, they seem to emerge from their usual apathy. They dance to the sound of drums and flutes, shout and pray with profound fervor. They heartily devour in a communal meal the flesh of the victims, drink themselves out of their minds, and resume their dances until they fall exhausted to the ground.

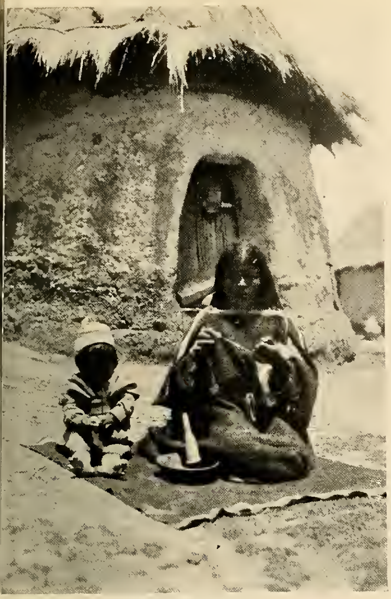
At carnival time, they symbolize the desired fertility by huge wreaths of fruits and cheese hung from the tower of the church, and by the outfits of the dancers, who carry bundles of fresh grass, strings of brown eggs, dead ducks, stuffed vicuñas, and other objects.

Between feast periods, life is dull and monotonous. People scatter to their small huts in the pastures, where they watch their herds. Their exist-

▾ CHIPAYA WOMAN nursing a baby

▾ THESE INDIANS are so dependent upon llamas, sheep, and pigs for their subsistence that the women will even play wet nurse to young animals





▲ **Chipaya Indian** spinning yarn for their woolen garments and blankets

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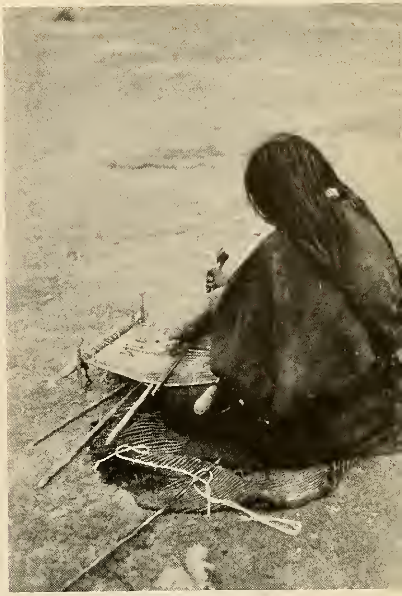
. **Chipaya couple.** Family life lacks tender-
. Quarrels between husband and wife are fre-
nt and often terminate in mutual thrashings

ence is not idyllic. The village is rent by the rivalry and jealousy between the two main clans; and pitched battles with slings or with cudgels are fought over the water rights. Stealing water is the supreme crime and is the cause of many internal feuds. Family life lacks tenderness. Quarrels between husband and wife are frequent and often terminate in mutual thrashings. In too many cases, parents-in-law interfere, with consequent turmoil. Sometimes these family spats end seriously. A few days after I had first arrived at Chipaya, I joined a crowd rushing toward a small hut. Entering, I found a woman on the ground. Her eyes were widened, her face convulsed, her tongue swollen. She had just taken her life by pulling a woolen rope around her neck with one hand, while she held her baby with the other. The Indians regarded the scene dispassionately, none showing pity or fear. Even the parents and relatives stared at the body without apparent comprehension. Suddenly, as if prompted by a signal, the women sank to the floor and started the shrill chant of the bereaved. Meanwhile, I asked questions, believing that a crime might have been committed. But the Indians merely informed me that the woman had killed herself to annoy her husband, with whom she had quarreled at breakfast. Perhaps she had hoped to loose a spirit that might plague the man who had spoken to her so harshly.

Another aspect of Chipaya life that is particularly impressive to a white man is the unbelievable filth of these Indians. Dust and grease build around their bodies in a thick crust, which breaks at the joints. Lice, also, constitute an unpleasant part of the Chipaya personality. In the whole world, only Tibetans possibly rival the Chipaya in bodily filthiness.

Yet this sad people, squalid, indolent, untutored, and indescribably poor, are a carry-over from the days of the Incas, whose nation once ruled over large parts of South America with fabulous wealth and mighty armies. The Chipaya are the only Indians who may still give us an idea of rural life in a remote corner of a great empire. Time has passed them by, leaving them almost untouched. When the round Chipaya huts and the blood sacrifices to the Inca Gods vanish, one of the last living remnants of the Inca empire will also have passed from the earth.



▲ **This woman** is weaving with a loom common in pre-Columbian days. One end is supported by pegs stuck into the ground, the other end is attached to her belt

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▼ **Little girl** and her piglet. Pigs are important economically to the Chipaya, yet on occasion the Indians make pets of them

DDT—THE ATOMIC BOMB OF THE INSECT WORLD

Continued from page 405

trol program as a whole, DDT actually played a very small part. The addition of DDT to the kerosene for control of larvae, would not have added greatly to its efficiency, since tests have shown that DDT is effective for only about three weeks in strengths that are safe for fishes. One part of DDT in 10,000,000 parts of water will kill fish. The same concentration is not as effective in mosquito control as oiling, although it can be applied at much lower cost.

Exit Malaria

Malaria, carried by certain species of *Anopheles* mosquitoes, is one of the most serious diseases in the world. It occurs throughout the tropics and over much of the temperate zones, and approximately 300,000,000 people suffer from the disease or its effects at all times. The number of deaths exceeds 3,000,000 annually, but this huge death toll represents only a fraction of the ravages of the disease. Those who suffer from it often require months to regain their strength and vitality. Every possible method of reducing the number of victims is obviously worthy of trial.

The mosquito control program in Panama, consisting of draining swamps and oiling temporary pools, together with screening of buildings and treating of patients in mosquito-proof rooms, is a classic example of malarial control. The actual control of the *Anopheles* is directed against the larvae, and it is a year-round job. Fresh mosquitoes are always invading the edges of control areas, and victims of the disease bring the plasmodium parasite into the zone in their blood and are potentially dangerous carriers if adult *Anopheles* are present.

The use of DDT is changing our tactics in fighting malaria, and there is every reason to believe that the disease can be wiped out over very large areas. The new system of attack has been thoroughly tested in Italy and is being tried in this country on a large enough scale to determine its efficiency under American conditions.

This control measure aims at the adult mosquito. It consists of spraying the insides of buildings with DDT in kerosene, making sure that all dark places are very thoroughly treated. This does not prevent mosquitoes from entering the treated building, but it pretty well guarantees that they will not escape from it. Any mosquito resting on a treated surface is practically certain to die. Even though it may have sucked the blood of a malarial victim, there is little chance that it will live to transmit the disease to anyone else.

The great value of DDT in this type of treatment is that a single application will remain effective for at least six months, perhaps for a year or more. In Italy it was proved to be effective for eight months. Also, the cost of the material should not exceed two or three dollars for the average home—a very cheap price to pay for the elimination of malaria, not to mention the riddance of pests.

The same treatment should also control dengue, a less dangerous but debilitating disease that is transmitted by the yellow fever mosquito, *Aëdes aegypti*. Indeed, it should be even more effective, because *aegypti* breeds in larger numbers about urban dwellings. Its distribution is limited to areas having an average temperature of 65° F. or higher.

Do's and Don't's

In closing, it might be well to give some brief advice regarding the use of DDT.

DDT is a deadly poison if taken internally. It should always be marked as such and kept out of the reach of children and animals. We know nothing about its possible cumulative effects on human beings or pets. It causes skin eruptions on some people and "hay fever" in others. There is no evidence that it is injurious if inhaled in the open. Spraying in a closed room should be strictly avoided—all windows should be open.

DDT is no more effective in the control of *Anopheles* larvae than Paris green. It is generally less effective against bottom-feeding mosquitoes than oiling is, and its effects do not persist any longer, but it is cheaper to apply. However, it is deadly to cold-blooded animals when used in mosquito-killing quantities.

DDT kills birds as a result of their eating insects killed by it.

DDT should not be used outdoors at the present time. We may discover safe ways to use it against certain plant pests, but we know too little about it to recommend its general use.

DDT, used properly in the household, will destroy pests and it promises to eliminate malaria and dengue, two widespread diseases, if applied inside all buildings where these diseases occur. It is much less efficient as a fine spray than as a coarse one.

Finally, do not use DDT unless you know you are using it properly. Your results will be most disappointing unless it is properly applied.

All remarks concerning DDT will apply also to Gammexane, a British product said to be even more toxic than DDT.

now is the time

to start thinking about Christmas cards and gifts. May we suggest—

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Prehistoric remains

In Southern Nevada

Photographs by Richard L. Cassell

▲ A typical scene within a few hundred yards of where the tusk was found, showing a cliff of the fine compacted silt characteristic of the region

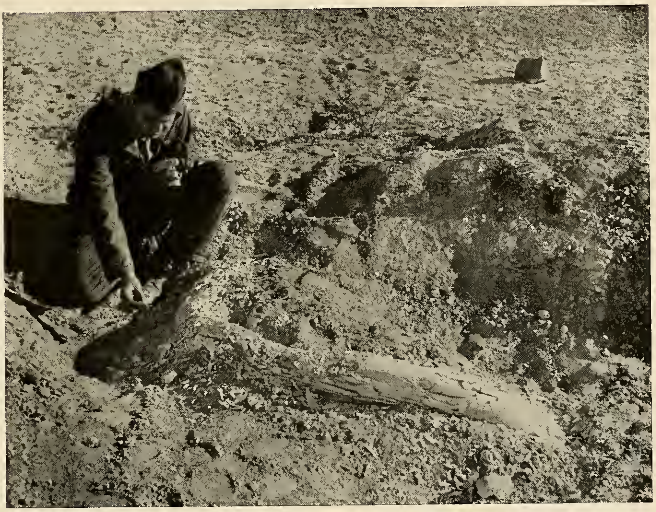
In southern Nevada, 20 miles north of Las Vegas, a dry wash yielding the remains of numerous prehistoric animals was discovered by Mr. Fenley Hunter, of Garden City, N. Y., and announced by George Gaylord Simpson in 1933.* Captain Richard L. Cassell, whose nature photographs have been seen from time to time in Natural History, recently sent the accompanying photographs of the locality, where he is on Army duty, showing the tusk of an Imperial Elephant in the ground.

These finds are interesting chiefly because there is evidence that human beings lived in the region at the time of the extinct animals, as indicated by charcoal and a hand-worked piece of obsidian. Not only have elephant remains been found, but also those of horses, camels, deer, bison, ground sloths, and at least two small rodents.

"Except for the cobblestones of the 'stream' bed," writes Captain Cassell, "the entire vicinity of several square miles is of a fine compacted silt, which crumbles freely and is of an off-white color. It is within this material that the prehistoric remains are found. Unlike the almost perfectly preserved prehistoric remains from the La Brea Tar Pits of southern California, however, these fossils have undergone marked disintegration.

"It is thought by some that the remains were carried by floods into the region from the mountains that bound the entire section. The nearest range is about 30 miles distant. However, what forces have been acting in these parts for the past 40,000 years or so is anybody's guess."

Considerable work has been done in the area by the Southwest Museum and the California Institute of Technology. The readiness of the fossils to crumble is urgent enough reason for amateurs not to disturb them.



▲ The tusk of an Imperial Elephant which roamed southern Nevada thousands of years ago. There is reason to suspect, however, that primitive man had entered the region by the time the deposits were laid down

➤ Crumbling results from even slight stresses in these delicate remains, preventing the removal of specimens by any but the most skilled hands

---

*American Museum *Novitates* No. 667.

TWO SQUARE YARDS

—And down you go, to study nature photographically at ground level

By THANE L. BIERWERT

Acting Chief, Division of Photography
American Museum of Natural History

All photographs by the author

WE hold our heads high because evolutionary forces are strong. Who has thought of crawling about on his hands and knees as an occasional change? We miss many wonderful sights by not getting down to earth once in a while. On the ground and near it, innumerable plant and animal situations can be observed. Unbend the man-made dignity and become as curious as a child seeking an adventure.

Despite the threat of November's leaden skies and the too crisp air, dress for photographic action and journey to a wooded area adjacent to a field. Wander along the transitional zone, head down for better study of the plant life on the ground. Watch for a spot that contains a wide variety of specimens. When you find it, get down on all fours, probe around a bit, and clean the area by removing dead leaves, twigs, etc., but take care to retain the naturalness of the setting. If your woods and meadow are away from the beaten path of cityfolk, a few square yards of ground will reveal various types of photographic subjects.

For this day's photography, we need a low tripod and some method for making close-ups. The tripod can be one of the small, table-top models or of the larger type if speading the legs will lower the head close to ground level. With the latter, a prop may be needed to hold the camera the right distance above the ground. A panoramic and tilting tripod head or a universal joint will permit easy maneuvering of the camera while you are composing the picture. Close-up lenses and a collapsible ruler are packed in the gadget bag. The complete set will enable cameras that are not equipped with long bellows to work as close to the subject as ten and one-half inches. At short distances, the depth of field is exceedingly shallow; so remember to use as small a lens aperture as the sunlight and wind will allow. The camera is operated at crawling eye-level so that we may avoid the foreshortening that occurs if we photograph plants from a standing or even stooping position. Backgrounds must be surveyed carefully from this low angle. To think of pictures in terms of so low an eye-level will cause more wear and tear on the knees than on the head.

Among the prominent plants will be the slowly browning burdock with its burry, globular seeds. Instead of the usual over-all picture, select a section of the plant showing the thick stems, heavy leaves, and viciously hooked fruit. The illumination will be best when the rounded fruits have a shadow along one side to show the shape. Another large plant is the milkweed, which early in the month may still have a few pods with parachuted seeds undispersed. A striking portrayal of this plant can be made by shooting upwards at the pointed pods silhouetted against the sky, with the sunlight streaming through the white, silky, buoyant down.

On the ground in the shady spots will be the creeping club-mosses, which are often used for Christmas decorations. This shiny, dark green plant with its cedarlike leaves produces erect candelabra-like fruiting stems. A carpet of club-mosses offers many possibilities for interesting compositions. A low camera position and glancing sunlight will create pleasing pattern photographs. It will be wise to use the exposure meter, because of the dark tones in the deep green caused by the acute illumination.

▲ THE SHAGGY YELLOW WITCH HAZEL offers one of the few opportunities for flower photography at this season

▲ FOWLER'S TOAD will pose readily on a warm day—if you can find him

Even smaller, but just as noticeable as any other plant, are the lichens that grow just inside the woods. Some will appear to be splashes of paint on rocks, while others will have definite forms and shapes. The flat, round, gray-green parmelia clings tenaciously to smooth rocks. An acorn or a leaf should be included in the picture to show the relative size of this interesting plant. Near by, on rotting branches you can photograph the minute, coral-like, gray cladonia. To show the form of this species, which may be all of one inch in height, the negative must be sharp enough to stand enlarging. These small plants are exceeding fascinating, and once you know them, you will search for new species as diligently as most of us do for wild flowers.

The flowers are gone at this time of year, except those of the shaggy, yellow witch hazel; and to photograph them, we stand up.

It may not seem possible, but on our two-square-yard plot we are even able to find animal life, if we look for it.

▲ "British red-coats": one of the lichens that will attract the "down-to-earth" camera-man in his autumn explorations. (*Cladonia cristatella* enlarged about 3½ times)

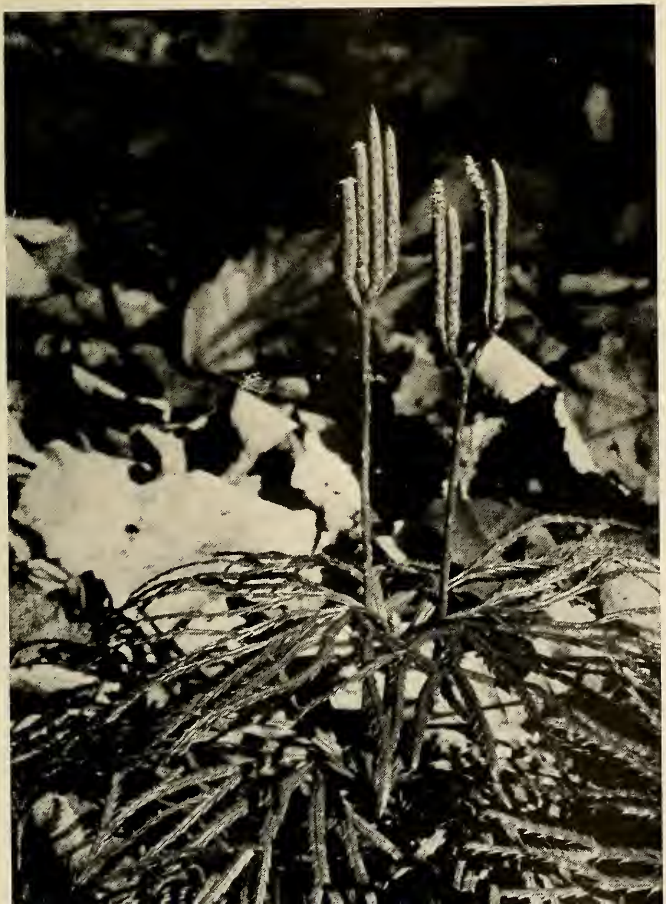
Under stones, branches, and rotting logs huddle beetles, ants, spiders, and crickets. The coolness of the weather makes them sluggish and more inclined to pose for a picture. Select a natural habitat for an individual animal. Vary the scenery for each animal so that it will not be obvious that all the pictures were made on the same day. Set up the tripod and camera, and focus on the spot where the animal is to be placed. Gingerly place the "model" in position, being careful to cause no damage to the legs, wings, or antennae. Within a few minutes the creature will warm up in the sun and strike a natural pose. As a reward for such good behavior, return it to the protection of its winter home.

In the humus beneath the leaf matting and just below the surface of the ground in the wooded area, we might be able to uncover a red eft, a toad, or a wood frog. These batrachians have but recently dug in for the winter months, and if we get out early enough in November, we shall not harm them. On a warm day these animals will pose very readily. Place the creature on a predetermined point, facing in the direction for the best illumination. Slowly coax and guide it into an alert stance. Because of the unnatural temperature, this type of work is quite critical. Unless a person is a good naturalist, he should not attempt to dig out and then return amphibians or other hibernating vertebrates to the winter quarters. There are too many other interesting subjects waiting to be photographed at this time of year.

On our small piece of ground, but above crawling height most of the time, we might see a number of cocoons waving in the breeze. A common one is the brown, silky, pointed bag of the cecropia. These are a problem for the impatient photographer on a windy day. Fortunately, they are anchored so strongly that they come to rest very rapidly when there is a lull. Photograph them against a blue sky, without a filter, with textural illumination to show the structure of the cocoon surface.

It is not necessary to venture far afield for a variety of pictures. They can be found on a small piece of ground that has been chosen for its diversity of natural material. Two square yards is a tremendous piece of ground if you undertake to record everything on it. Should you have facilities for working closer to specimens than a distance of 10 to 12 inches, you can select an area of only one square foot.

The few plants and animals mentioned above are but a small percentage of the dozens that grow on a two-yard plot. How many different ones can you find?



◀ A low camera position will give pleasing effects with the club mosses, which are often used for Christmas decorations

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THE NATURALIST ON A "BUSMAN'S HOLIDAY"

Continued from page 424

including a pair of white pheasants, common enough in parts of Tibet, but known only by a handful of specimens in American museums. The Britisher and the Army officer made a ceremonial call one afternoon on the Grand Lama of a large Tibetan town and afterwards went for a walk along the river bank in their best uniforms. They noticed a duck swimming in an eddy of the stream. Taking careful aim, the Britisher fired a pebble with his slingshot with perfect precision. But to their horror the bird floated out into midstream. And so the surprised townsfolk were treated to the sight of two solemn representatives of the United Nations capering up and down the bank of the Brahmaputra river, waving branches of driftwood and trying frantically but without success to reach their prize.

Sometimes this indulging of hobbies can be a bit dangerous. An authority on insects from Harvard stationed on New Britain Island was mauled by a crocodile not long ago. For some reason or other he stepped on the beast while out for a stroll, looking for bugs no doubt.

A buck private, an old hand in peacetime at searching for birds and their nests, got himself up into a sort of tower in a deserted barn in North Africa. There were four stork's nests, one at each corner of the tower. Just as he was getting absorbed in the problem of which stork's egg to pick for his collection, the Germans began shelling the place, thinking it an artillery observation post. There was a big hog-wallow down below, and the private lost no time in jumping. He landed safely but at the cost of one uniform and a cracked stork's egg. Finding that the egg was just about to hatch and being a thrifty soul, our hero attacked the problem with infinite patience and succeeded finally in skinning and preserving a good specimen of baby stork.

And so it goes. All around the word today are scientists and naturalists in uniform. Many of them have been able to get to places that were little known even to museum explorers before the war. Most of these men worked up to twelve hours a day; some, of course, were on the fighting fronts, and yet nearly all of them have tried from time to time to look about and do some collecting. Furthermore, the Army encourages this sort of thing up to a point, knowing full well the morale value of hobbies for men often bored and lonely at unfamiliar sights and places far from home. A considerable number of men, particularly in isolated posts, have written through Special Services to the United States National Museum in Washington, asking for copies of the "Field Collector's Handbook" printed by that museum, which tells how to make a collection of everything from fish to fossils.

Collectors are hard to embarrass. Not long ago I was staying at a small Army camp in India. It was late afternoon. Dressed in a towel, I was standing at the window of my palm leaf hut shaving. Suddenly I saw a green woodpecker fly into a tree about 75 yards away. It was a forest bird which I had not seen before. Without thinking, I grabbed up my small shotgun, which I had been cleaning, and ran out. I stalked the tree, finally saw the bird and fired. In the silence that followed I heard a murmur of voices and looking round, remembered what I had completely forgotten, the C.O.'s cocktail party. There on a small hill in full sight was a large group of guests staring open-mouthed at the sight of a gawky creature, towel precariously hitched, stalking out of the bushes with gun and bird.

"I knew it," said somebody. "Crazy as a coot."

Now that the war is over, I am sure that other rare specimens will be secured, particularly in the Pacific. Few people know that there is a small swamp bird, a rail, found only on Iwo Jima and one of the Bonin Islands. There isn't a museum in America that has a specimen. Has anybody seen one yet? To be sure, they may be extinct, but they can hide better than any Japanese soldier I've ever heard of. There should still be some around. I wish somebody would find out.

One of the Ryukyu Islands, just south of Okinawa, is called Miyako. There's a kingfisher on Miyako known only from one specimen in the Tokyo Museum. It's probably not rare at all. Before the war no one ever got to Miyako to find out. Well, now's the chance. If I know my collecting friends, one of them will manage to take a busman's holiday on Miyako Jima sometime soon.

December

NATURAL HISTORY

1945

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LETTERS

SIRS:

I very much desire to express my appreciation of the thought contained within Dr. Shapiro's editorial, "Man and the Atom" in the October issue of NATURAL HISTORY Magazine. I think it buoys up the confidence of the rest of us, that at last our scientists may take a hand, as well as an interest, in lending their talents and training to the guidance of social problems and human affairs into channels of constructiveness instead of threatened annihilation. . . .

We look forward to these articles as an important addition to the rest of the fascinating material within the pages of NATURAL HISTORY.

MRS. J. P. WAYNARD.

Pray, Montana

* * *

SIRS:

. . . I wish to express my thanks for your most logical editorial on "Man and the Atom," especially the closing statement, recommending the united action of all men interested in human affairs to work for a political and social organization to make war impossible. The terrific destructive force now discovered and made available should be controlled by all the world before it possibly may result in irreparable damage and destruction of our civilization . . .

I sincerely hope you will continue your efforts to arouse the people to the great danger and to secure governmental action of a world-wide nature, before it becomes too late . . .

The "Franklinia" cover design interested me, as well as the short article describing it. Fifty-one years ago, while in Asheville, N. C., I visited the home of Mr. Vanderbilt nearby and greatly admired his palace and gardens. In talking with the gardener of the place, I noticed one of these trees and was told that it was a "Gordonia" and very rare, but not hardy in the North. However, I asked him to send a small specimen, which he did, and I planted it in front of my home, then 100 Upper Mountain Ave., Montclair, N. J. Contrary to the report, the tree grew and now is about a foot or more in diameter. It has bloomed profusely every year, notwithstanding heavy snows and temperatures to 15 degrees below zero. I have been told that a similar tree exists in the Arnold Arboretum, Cambridge, Mass., and that another exists in the botanical gardens at Prospect Park, Brooklyn . . .

The tree has attracted the attention and admiration of many friends, and I am much pleased to see it given proper recognition and praise.

CHARLES C. WEST.

Morristown, N. J.

HYPNOTIZING OF BIRDS OR ANIMALS

SIRS:

As a boy I learned to "hypnotize" canary birds and chickens by laying them on their side and drawing a chalk mark directly away from their bill. The chalk mark is not needed as a rule; they will lie quietly without. It also works with many wild birds.

This positively *does not* work with dogs, cats, or other animals so far as my experience has gone. Nevertheless, articles are written on "hypnotizing" animals, and recently a showman here claimed to do it.

I have kept guinea pigs for years. Recently a visitor told me that he had seen Filipino attendants in a laboratory "hypnotize" guinea pigs "by just laying them down" and that "they stayed that way indefinitely." I have never been able to do it.

Can you advise concerning the foregoing? . . .

VAN ALLEN LYMAN.

Balboa, Panama Canal

The following answer is given by Dr. Frank A. Beach, Curator and Chairman of the Department of Animal Behavior at the American Museum of Natural History:

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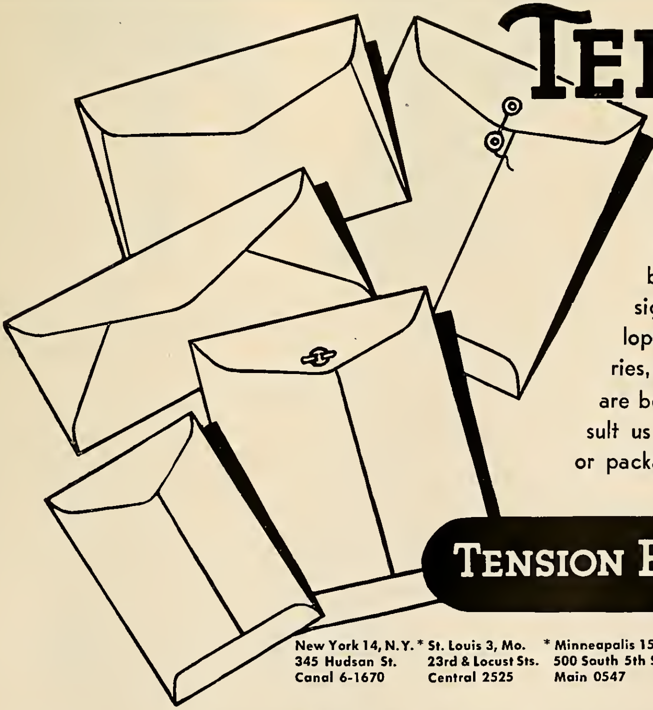

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The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President — ALBERT E. PARR, Director

VOLUME LIV—No. 10 ★ ★ ★ ★ **DECEMBER, 1945**

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From a Kodachrome by Edward Bailey and Leon Boltin. See description at right

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THE COVER THIS MONTH

THE SNOWY OWL

The snowy owl is one of the interesting inhabitants of the Arctic regions in both the Old and New Worlds. As with various other animals of the far north, its white dress makes it inconspicuous against a snow-covered background, but does not serve so well against brown fields and evergreen vegetation.

This owl hunts by day and feeds largely upon lemmings, rats, meadow mice, hares, squirrels, and such prey, but it also captures a few ptarmigans and ducks and even fish. Some individuals make their way south to our borders every winter, but in years when food is scarce—which happens every four to nine years—a real invasion takes place and hundreds or even thousands are reported in many parts of this country, sometimes as far south as North Carolina.

The snowy owl nests on the open tundras and makes its simple nest in a mere hollow on the ground or on a low tussock, with little or no lining. The white eggs—usually five to seven or eight—are laid at broken intervals, and incubation starts with the first egg, so that by the time the last egg is hatched, the oldest young may be two weeks old or more.

JOHN T. ZIMMER.

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LETTERS *Continued from page 437*

Your question might serve to introduce a "tercentennary celebration" commemorating the discovery of "animal hypnotism," for in 1646 a Jesuit priest, Athanasius Kircher, published a book in which he described the trick of "hypnotizing" chickens in exactly the manner to which you refer. The result so astonished his contemporaries that the phenomenon became known far and wide as *Father Kircher's Wonderful Experiment in Bewitching Hens.*

It might have been better if the term "bewitch" had been retained, because the phrase "animal hypnotism," which was introduced about 200 years later, only served further to confuse an already obscure subject. The condition observed in animals bears only the most superficial resemblance to true hypnosis as seen in human beings. So little is known concerning the basis of hypnosis that there would be no profit in any extended discussion of the subject, but it should be emphasized that the hypnotized subject or patient is put in a peculiar mental state which permits him to accept readily the suggestions of the "operator." Everything depends upon the subject's maintenance of a receptive frame of mind. The transference of ideas, feelings, and emotions from operator to subject is the keystone of the hypnotic trance.

Nothing like this occurs in lower animals. The so-called hypnotic condition in animals involves two unique types of behavior. The individuals affected remain relatively motionless for varying periods of time, during which they fail to show any response to many external stimuli that ordinarily would elicit a definite reaction. Physiologists and psychologists who have studied this phenomenon in animals refer to it as *tonic immobility.*

Inducing the state

Tonic immobility can be induced in a wide variety of animals, ranging from planaria to higher mammals; and in different species the condition may persist from a few seconds to more than an hour. Among the invertebrates, certain arthropods are particularly susceptible and become immobile in response to light touch upon any one of several critical regions of the body,—the thorax, antennae, or the bases of the wings. To interrupt the motionless state it is necessary only to touch the animal's feet.

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Some amphibians and reptiles show tonic immobility when properly stimulated. The American chameleon can be induced to remain motionless if it is suddenly turned on its back and restrained from any immediate righting movements. Many common frogs and toads "freeze" under similar treatment, and I have seen the same condition induced in alligators.

Many birds and mammals pass into a state of tonic immobility in response to sudden inversion followed by a brief period of restraint, and, as your friend correctly informed you, guinea pigs react readily to this treatment. In the library of the American Museum there is a book entitled *Human and Animal Hypnosis* which contains pictures of crabs, toads, frogs, lizards, alligators, crocodiles, pigeons, owls, peacocks, hedgehogs, rabbits, guinea pigs, cats, lions, foxes, bears, monkeys, and chimpanzees, all in the condition of tonic immobility produced by suddenly turning the animals on their backs and temporarily preventing them from righting themselves. I hasten to add that I have not personally observed this experiment with any mammal larger than a cat, and I confess to some wonderment at the man whose scientific zeal is strong enough to induce him to play catch-as-catch can with a bear or lion,—but the important point is that tonic immobility

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unquestionably can be induced in many different animals by the same technique.

The explanation

Although no one knows for certain what bodily changes may be responsible for this curious behavior, it is suspected that the treatment causes the release into the circulatory system of specific glandular secretions, and that these hypothetical chemical agents partially paralyze certain higher nervous centers in the brain. It is significant that in any given kind of animal the condition of tonic immobility usually persists for a definite and relatively unvarying period of time. This observation has been taken to indicate that the chemicals lose their potency at a predictable interval after their introduction into the blood stream.

One very interesting aspect of tonic immobility lies in the similarity of this condition to the behavior known as "playing possum" or "death feigning." Members of several animal species react to the appearance of a potential enemy by assuming an "upside-down" position, remaining quite motionless, and failing to exhibit normal responsiveness to many types of stimulation. This behavior, which is often erroneously interpreted as a rational response intended to deceive the would-be enemy, is probably nothing more than a variant of tonic immobility.

Although tonic immobility and true hypnotism have very little in common, it is reported that the former state can be induced in human beings. Perhaps you are sufficiently adventurous to try the following instructions, taken from a very serious scientific article. "If a man bends forward at the hips to form a 90° angle, places his hands upon his abdomen, takes a deep breath, and is then suddenly thrown violently backward through 180° by two men, one standing on either side of him, a state of pronounced tonic immobility lasting some seconds may result." To this lucid understatement I can only add that I regard the predicted consequences as being highly probable! Should you care to carry out a practical test, I would be interested in learning the nature of your findings.

* * *

Sirs:

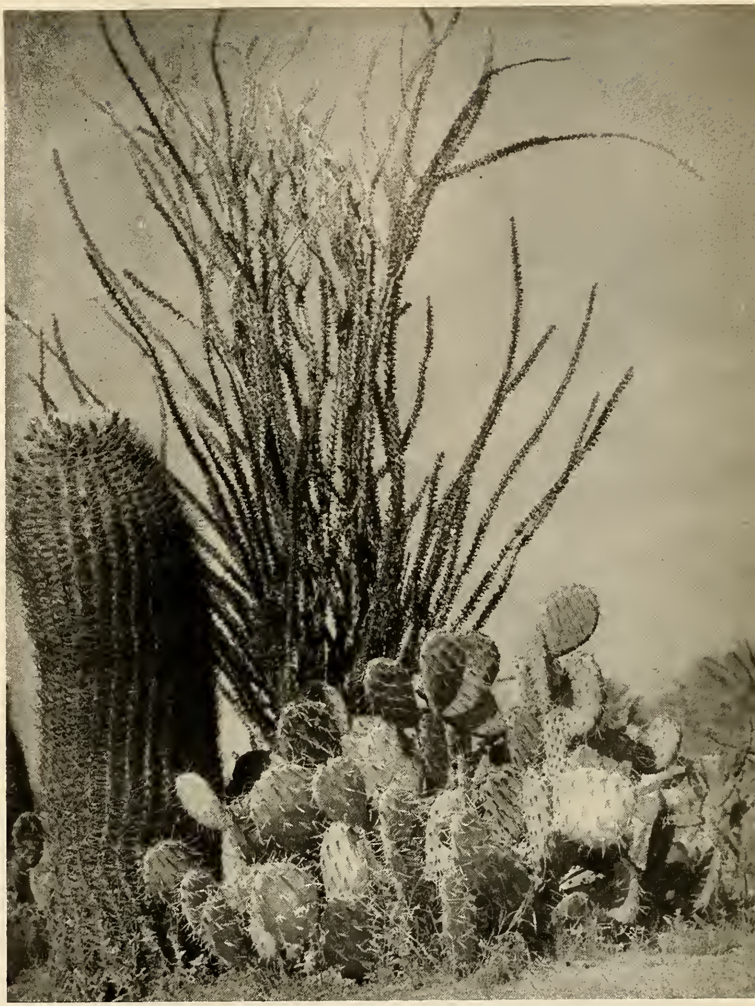
At first glance your October issue, containing articles on the atom and on Arizona ground waters, looks most interesting and worthwhile. I shall get at it soon.

At the same time, I confess to a grouch on your magazine because the portrait of an Arizona scorpion you published in the June issue shows so little of the normal *joie de vivre* of those desert cusses—so little "punch" in its attitude and so obligingly poised a tail. . . . Having known them intimately and endeavored to photograph them, I can only conclude that this scorp had either bitten the photographer and was repentant or that the creature had been anaesthetized, as I personally have often done.

I further desire to say that the writer had certainly never been punched by a scorp, or he would not talk about bee stings. I have seen a six-foot 200-pound man put into a coma for almost 24 hours by one punch from a 2-inch Arizona scorp, and there was little utility left in him for the next 48 hours. And this is not just one instance. . . . As for myself, I have had the same experience and the same prostration. The pain is very great. I would prefer to deliberately caress a hornet's business-end every day than get punched once in 30 days by a scorp. . . .

Nathan C. Johnson.

Englewood, N. J.



Cacti and Ocotillo near Indio, California. A photographic study by Gladys Diesing

Dr. Willis J. Gertsch, Associate Curator of Insects and Spiders at the American Museum, offers the following explanation:

"I believe that the difference of opinion expressed by Mr. Johnson is due to a consideration of different species of scorpions. The 2-inch Arizona scorpion that he mentions as having laid a 200-pound man in a coma for almost 24 hours is doubtless one of the two extremely venomous Arizona species. About these we would have told a very different story. They are dangerous, and people fear them with good reason. However, most scorpions, in fact 95% of them, do not have a venom that is capable of causing serious systemic distress. As Dr. H. L. Stahnke,

Continued on page 477

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MEET YOUR ANCESTORS: A Biography of Primitive Man

- - - - by Roy Chapman Andrews

The Viking Press, New York, $3.00

WAR or no war, interest in human origins continues. For several years now many professional and amateur archaeologists have been away in the armed services, but neither the collection nor the publication of new data has entirely ceased. Digging foxholes and clearing ground for airfields in various parts of the world have yielded not a little new and valuable material. Meanwhile, the stay-at-homes, like the author of this book, have not been idle. The steady accumulation of new facts about early man makes it necessary to retell his story every few years in order to keep it up to date, and Dr. Andrews, possessed of more enthusiasm than the average professional, is well fitted for the task.

His book is concerned primarily with the physical evolution of man and only secondarily with his cultural development. It names and describes the principal skeletal discoveries of our direct and collateral ancestral human and pre-human types as made in Europe, Africa, and Asia during the last 125 years, with emphasis on Asia as the probable place of origin. Some attention is given also to finds of ancient man in America which, however, while suggestive, are mainly cultural. The romance connected with these discoveries must be taken for granted, but even the more or less technical descriptions should prove of interest to the lay reader. In addition to a lively and readable text, the book is illustrated with a space distribution map, a time distribution chart, and 18 drawings—five of which are copies of ancient cave paintings. Finally, the end papers supply a "family tree" to connect up the various parts of the main story.

Space does not allow extended critical comments. It must be said, however, that the author is a trifle too generous with Neanderthal man, both as to his antiquity and his cultural achievements. He might to advantage have filled out with additional names the empty spaces in his time chart. A specific slip is the word "first" for "fist" axes on page 148. But these and other minor details do not, of course, seriously affect the value of the presentation as a whole.

To meet our ancestors, even thus indirectly through the sterilized medium of a book, may not for all readers be an altogether pleasant experience. Like some of their present descendants they were rough fellows. But, on second thought, after becoming acquainted with man's past physical and mental achievements, one should —in spite of present doubts over the world turmoil—easily recover complete faith in mankind's future.

N. C. NELSON.

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JAPAN AND THE SON OF HEAVEN

- - - - - - - - - by Willard Price

Duell, Sloan, and Pearce, Inc.,
New York, $2.75

MR. PRICE, the author of *Japan and the Son of Heaven*, is already well known for his previous books on the Japanese, particularly for those dealing with the Japanese administration of their mandate over the Pacific islands. In this one he is concerned with the very core of the Japanese problem. What are we going to do with Japan and the Japanese after we have defeated them? It is, by this time, no secret that the Japanese militarists prepared their country for a career of aggression by a series of calculated moves. They built up their emperor into a figure of divine descent, inviolate and in theory all powerful. They fixed the seat of real power in the inner circle of the army and navy, with the chief of staff alone having direct access to the Mikado. By this device the emperor, ostensibly the point of all authority, was in reality a creature of the military and a façade to conceal the secret sources of power. To obtain national unity and complete subservience, the divinity of the emperor was inculcated into every Japanese, primarily through the educational system but also via every other available means of propaganda and emotional pressure.

The personal observations on the way the system worked are provided from Mr. Price's first-hand experiences from living in Hayama, the village where the Mikado maintained his summer home.

The solution Mr. Price offers is in direct opposition to the policy that seems to have been adopted by the Department of State. He believes the Mikado should be removed and an interregnum established, since he is the very symbol of Japanese power and continuity. Shintoism in its form of national worship of the emperor must be destroyed. With these measures accomplished, Mr. Price has no doubt that some form of democracy can assert itself among the people, once education is cleansed of its rank propaganda and the intellect of the country again exposed to the sanity and the light of the outside world.

HARRY L. SHAPIRO.

THIS IS THE PLACE: UTAH

- - - - - - - by Maurine Whipple

Alfred A. Knopf, $5.00
222 pages, 102 illustrations, 4 in color

"UTAH is more a condition of mind than a country," states Miss Whipple in this recent volume of the Borzoi Books on the American Scene. As one reads the text and marvels at the scenic beauty so well portrayed in the fine illustrations, he comes to wonder just what that condition of mind may be. I, at least, could not find a satisfactory answer in the text, which reminds me of a fine meringue covering a palatable pie. Light, pleasant, and interesting, it is not the substantial material which gives the pie, at least, the basis of a satisfactory food.

Yet, as one considers the book, in retrospect, there is the consciousness that it does contain a vast amount of information on such diverse subjects as the history of the State, its more picturesque inhabitants, and its interesting and scenic sites. The trouble seems to be that all these diverse subjects are so intermixed and intertwined as to result in a lack of continuity. Like a vast grab-bag, one never can be certain what the next paragraph will discuss. The result is a text that seems frustrating and completely unorganized, yet it is one of the most provocative that I have read in many years. There is a short history of the Mormon church with a revealing insight into the modern rebellions that are now affecting it; as I lay the book down I want to know more about this. There are a multitude of

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stories, anecdotes, and descriptions of back-country Utah; I am conscious of the desire to have a more rounded picture of these people. In short, if it was the author's intent to tell the story of Utah and its people, I can not concede that she has succeeded; but if it was her desire to rouse our interest, to whet our appetites to know more about this desert wonderland, she has been remarkably successful.

H. E. VOKES.

VERTEBRATE PALEONTOLOGY

- - - - by Alfred Sherwood Romer

University of Chicago Press, $7.50
Revised edition, 687 pages, 377 figures

A LONG-ANTICIPATED and welcome event in the field of evolutionary studies is the appearance of the second edition of *Vertebrate Paleontology* by Alfred S. Romer. The first edition of this most excellent textbook has been available since 1933, and during the twelve years of its existence it has been widely used the world over by students interested in the evolution of the backboned animals. It may be confidently expected that the new edition will continue the outstanding reputation established by the first one.

The new edition is considerably larger than the first, the ratio being 687 pages as against 491 pages. The increase is due in part to the addition of new material throughout the book, the inevitable result of new discoveries and new research, and in part to the important and useful addition of three new chapters on the history of vertebrates. Also, the classification of the vertebrates, a very valuable feature of the first edition, has been considerably revised and expanded in this new edition. Virtually all genera of fossil vertebrates are included.

Naturally, the addition of much new material to the existing chapters has resulted in the rewriting and rearrangement of considerable portions of the text. Details of the changes are too numerous to mention; suffice it to say that they bring the text up to date with a thoroughness characteristic of Dr. Romer's very comprehensive knowledge of the backboned animals.

The book is brought out in a new format, conformable with other textbooks of the University of Chicago Series. This is particularly apparent in the new type face and the cover.

Such criticisms as may be leveled against the new edition of *Vertebrate Paleontology* fall in no way upon the author. It is unfortunate that the publication of this book during the war made necessary the use of an inferior grade and weight of paper. The index is set up in type rather difficult to read. But these are minor criticisms. This new edition of *Vertebrate Paleontology* is a book that every student of vertebrate evolution will want to own.

EDWIN H. COLBERT.

THE LOST WOODS,

Adventures of a Naturalist,

- - - - - - - by Edwin Way Teale

Dodd, Mead & Company, $4.00
326 pages

HERE is a new book by the author of *Grassroot Jungles, The Golden Throng,* and *Near Horizons.* Mr. Teale,

Continued on page 478

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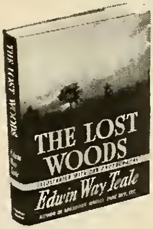

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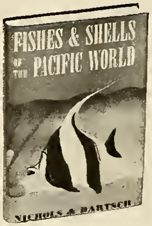

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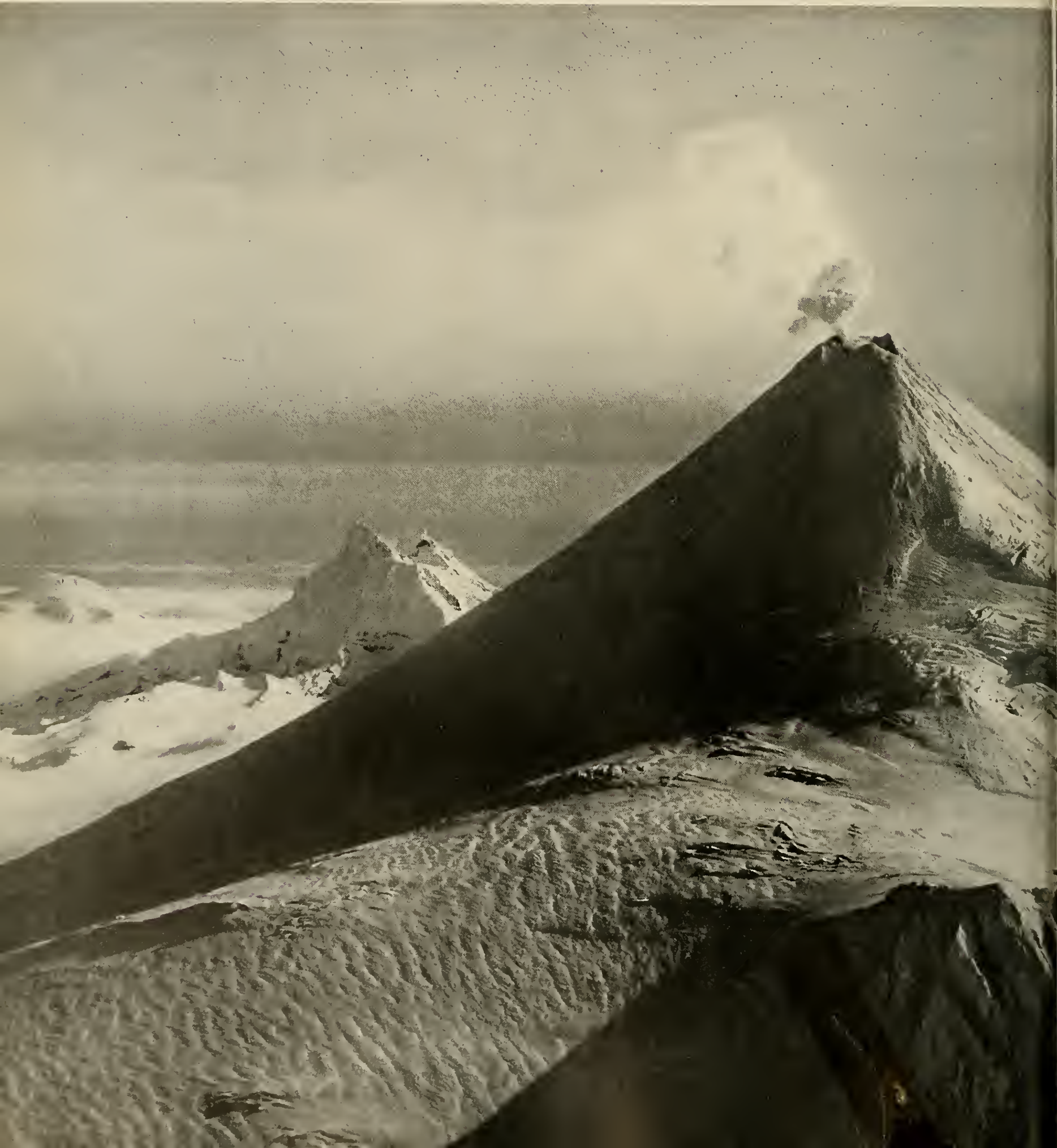
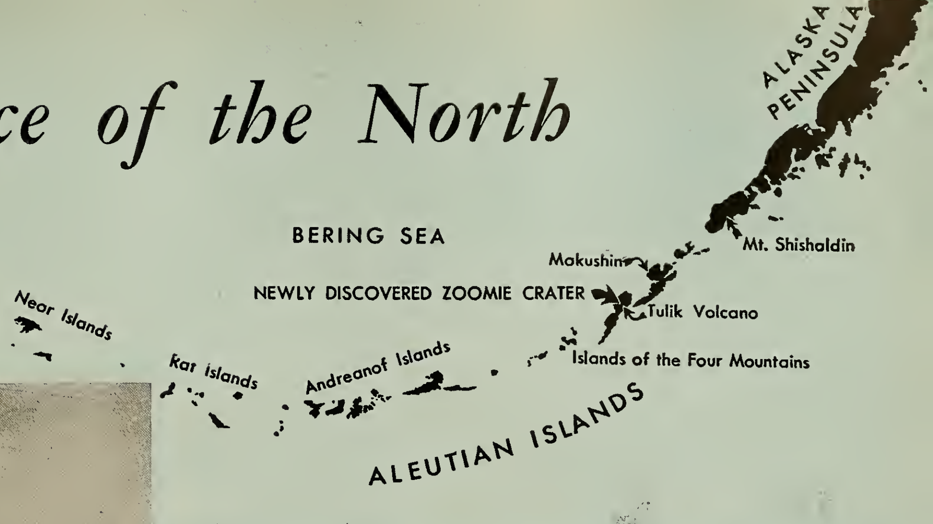
THE ALEUTIANS—*Island*

Awe-inspiring natural wonders, previously shielded from human eyes in the lofty Aleutians, yield their secrets to men of our armed forces exploring by Jeep and Duck



▼ MONARCH OF THE ALEUTIANS: Shishaldin (9387 feet), the largest and most perfect of the 30 or 40 volcanoes in the islands. Isanotski Peaks (8088 feet) and Roundtop Mountain (6155 feet) loom in the background

Necklace of the North



By DEAN FREIDAY

All illustrations official U. S. Navy photographs

It was a pleasant surprise to find myself on duty in a virtually unexplored corner of the world. Friends had ribbed me about the cold, the fog, and the williwaws when they heard that I was going to the Aleutians in 1942. Things looked pretty black when we sailed from Seattle. All kinds of stories had circulated about the hardships and the weather we would have to endure. The hardships were exaggerated, but the weather lived up to its reputation. Gradually, as the work became routine and a little recreation was in order, the surroundings became interesting and a number of us took up a study of the natural history of the region.

My training had been along geological lines, so I was naturally most interested in the earth history of the region. Correspondence with the American Museum of Natural History brought out the fact that almost nothing of the geology of the area was known. The only professional paper published was Capps' "Notes."* It outlined the over-all story of the region.

The Aleutian Islands form one of the great volcano belts of the Pacific rim. Geologically, they begin back on the mainland with Mount Spur in the Saint Elias range, and extend in a great arc 1500 miles to the westward, terminating in the Komandorski Islands. Geographically, they comprise some 14 large islands and approximately 55 smaller ones,—a group that is 900 miles long, beginning with Unimak and ending with Attu, as far as the American boundary is concerned.

Breath-taking sights abound throughout the chain. No one who has seen Mount Shishaldin from the air will ever forget it. Rising nearly 10,000 feet, directly from sea level, it smokes almost constantly. Not content with this masterwork, Nature outdid herself by providing a background of two unusually beautiful mountains—the twin-tipped Isanotski Peaks, and Mount Roundtop, giant sentinels in stone and snow.

East of this, on the peninsula, is Mount Pavlof, another giant that puffs out huge smoke rings every few minutes. Still farther up the peninsula are the Valley of Ten Thousand Smokes (the Katmai area), the Aghileen Pinnacles, and Aniakchak Crater. The Valley of Ten Thousand Smokes was created, achieving fame and the status of a National Monument, when Mount Katmai had an explosive eruption in 1912. It blew the top off the mountain and killed all the vegetation for miles around. It has even been said that some of the famous Kodiak bears lost their fur from the reaction of the rain and the volcanic ash. The Aghileen Pinnacles are jagged needles of rock and are of mysterious origin. Aniakchak achieved renown when it was discovered to be the largest crater known on earth, with a circumference of 22 miles.

The Aleutian region is studded

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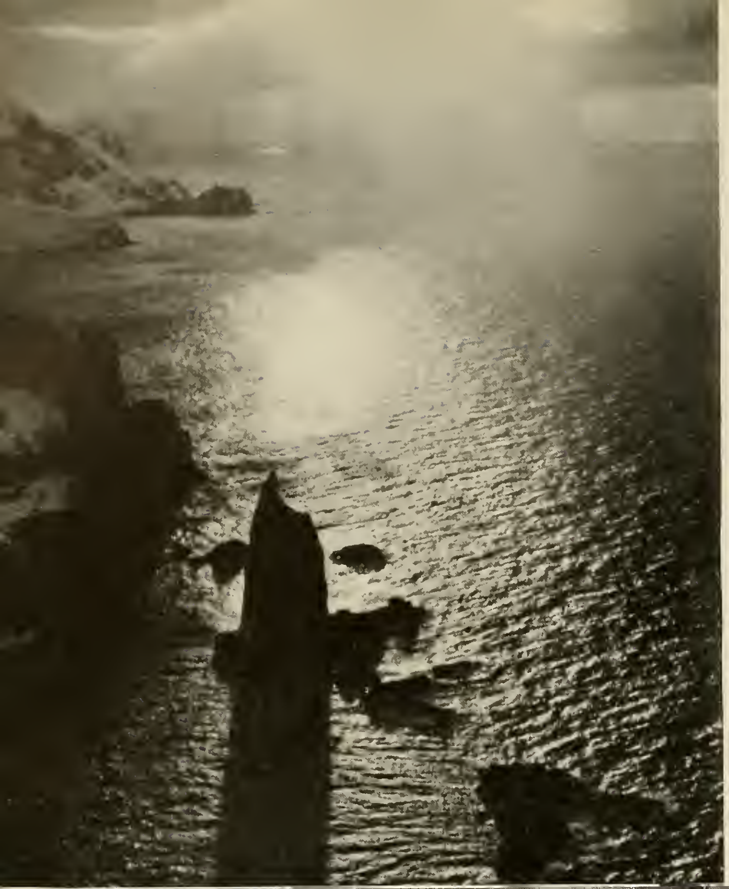
* Capps, Stephen R.: "Notes on the geology of the Alaska Peninsula and Aleutians." U. S. Geological Survey Bulletin 857-D, 1934.



with 30 or 40 active volcanoes. Some of these smoke continuously and cast a fiery glow against the night sky that can be seen miles at sea.

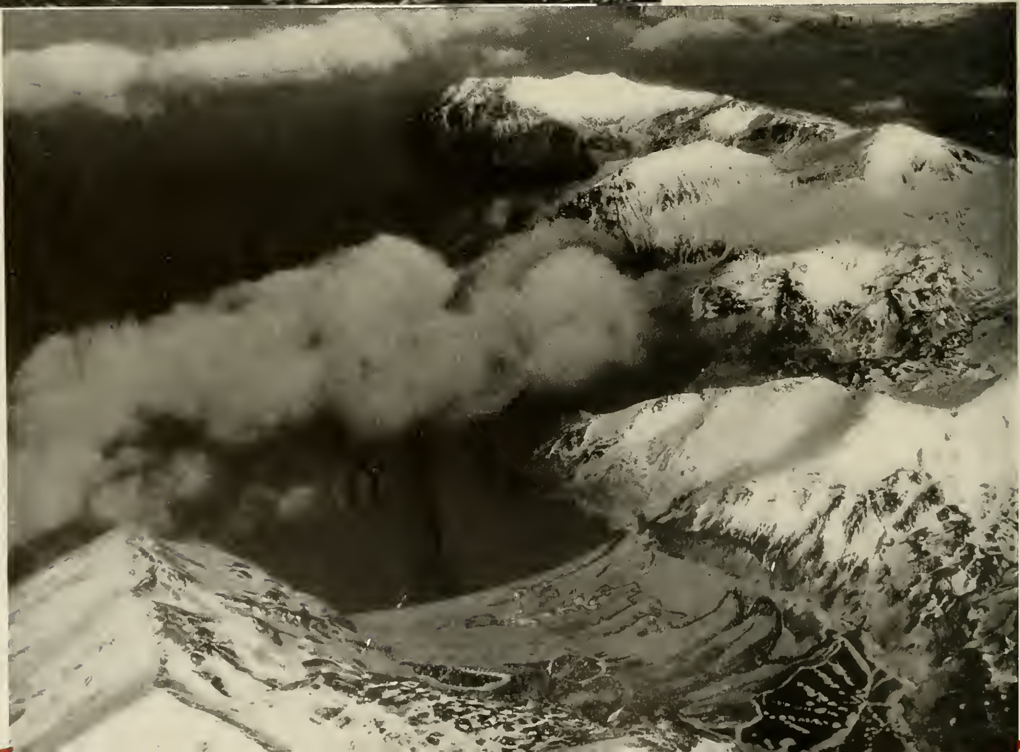
Beyond that, little was known, except for spot observations at various places along the line. The most recent maps of much of the area, at the beginning of the war, were those completed by the Russians in 1836.

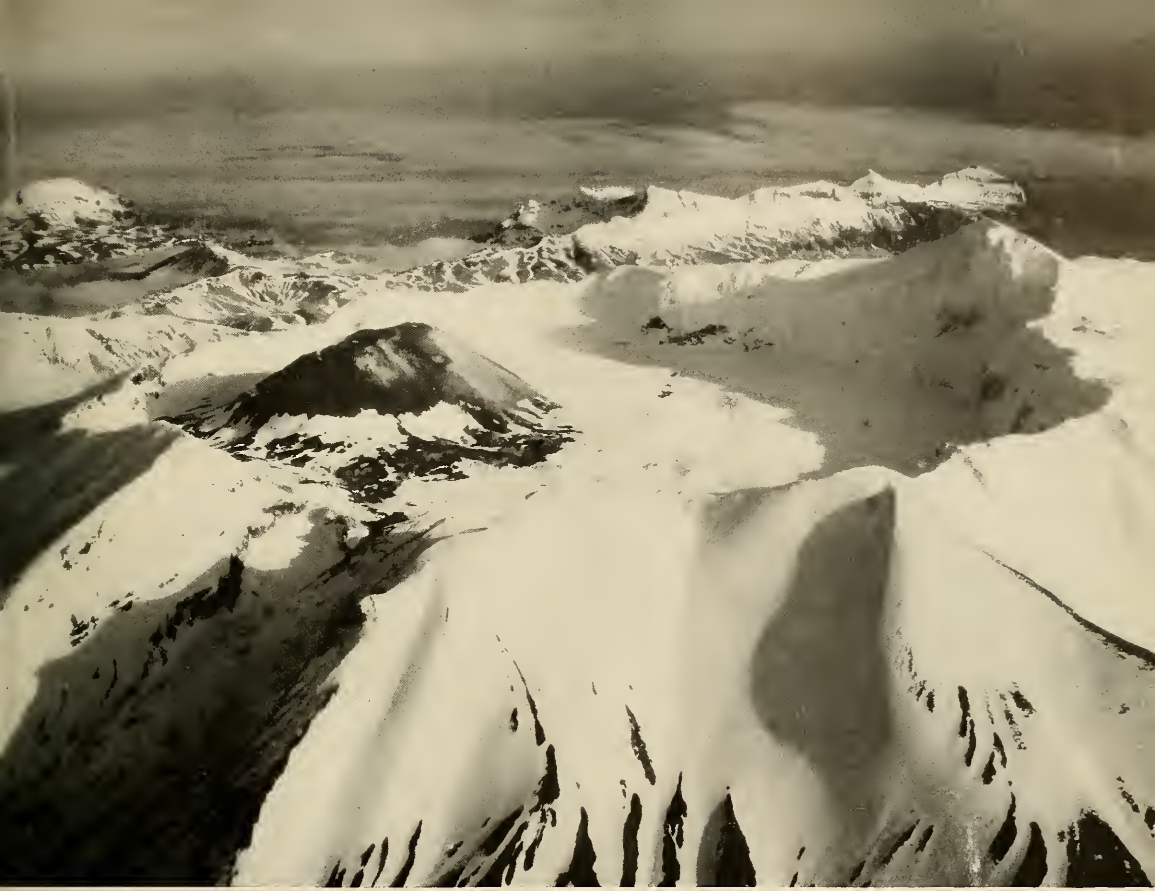
When the Japanese took Kiska and Attu after the raid on Dutch Harbor, hydrographic reconnaissance suddenly became very important to our armed forces. If we were to keep from losing vessels on uncharted rocks, more had to be known in a hurry. Detailed terrain studies also had to be made to facilitate emergency plane landings, and for the many other uses of war.

Some of this work was done by the photo lab to which I was attached. I flew many hops in our amphibious Duck over the near-by islands, photographing the country below. Gradually in such work, you get the feel

◀ GIANT OFFSHORE PINNACLES OF ROCK are so huge that they lose scale: Priest Rock, Unalaska Bay, 204 feet high

▼ WATERCOURSES FOLLOWING GLACIAL VALLEYS that end at the coast, back up fresh-water lakes behind the spits. Unalaska Island





▲ Akutan Crater, 4,244 feet above sea level, has lost its top, either by explosion or subsidence

of the country and become interested in the various features of the landscape.

The Aleutians are one of the most fascinating areas in the world from the air. Miles of utter desolation spread out below you,—peak after peak stretching as far as the eye can see. It is a country with its feet in the water. Bays and channels are everywhere. Two-thousand-foot cliffs are commonplace on the sides exposed to the sea. The atmosphere is sometimes so clear that smoking volcanoes several hundred miles away can be seen clearly. Giant offshore pinnacles of rock are so huge that they lose scale until a ship makes its way into the scene and assumes toy proportions. Extinct cinder cones and craters are everywhere.

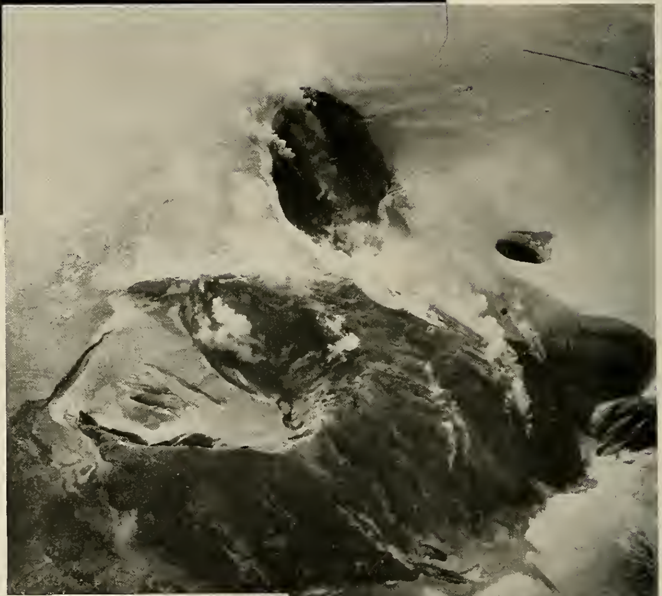
The panorama spread below you is a textbook on the igneous geology of a newly-formed land. Formation began in the Eocene period, 35 to 50 million years ago, and the process is still going on. You see knobs of bare rock exposed everywhere, with lush tundra filling in the hollows. U-shaped valleys give evidence of the part glaciation has played, and as scenic features they are surpassed only by the theatrical volcanoes. Hanging valleys break off abruptly at the sea's edge, and waterfalls hundreds of feet high tumble off into the sea.

Bay heads soon give rise to sand spits and begin the cycle that can be seen over and over. Watercourses following the glacial grooves that end in bays, back up fresh-water lakes behind the spits. As time goes on, the suspended sediment brought down by the rushing streams silts up the lakes. Muskeg swamps make a smaller and smaller oval of them. Finally, the whole area becomes marshy, and the stream meanders lazily across it.

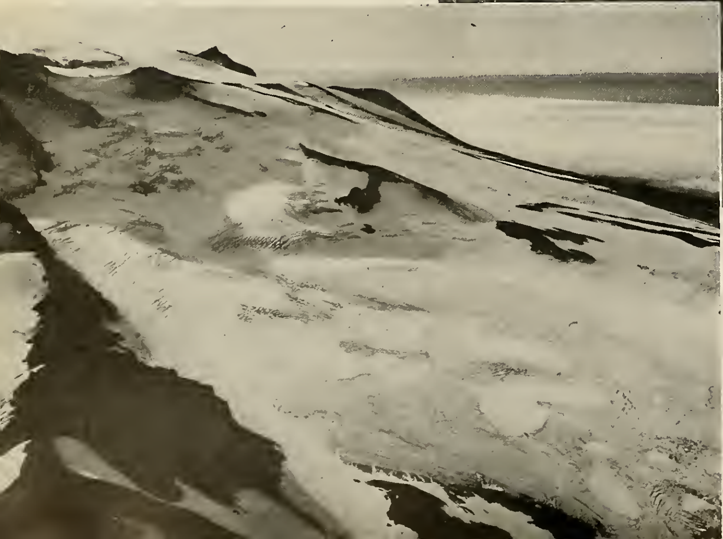
Straits and passes fill up in similar fashion and unite islets into islands. By this process, the Alaska Peninsula was gradually formed. Originally it was a series of islands similar to the Aleutians, but it methodically extended its way outward. The channels between the islands silted up through the action of shorewise currents, and layer after layer of volcanic ash was deposited from the many eruptions. The process is still going on. In historical times Isanotski Strait, or False Pass as it is more descriptively known, has filled in until it can no longer be used even by small craft. At low tide, the water is so shallow on the Bering Sea side that animals can migrate to and from the mainland. Eventually Unimak Island will lose its identity in a merger with the Alaska Peninsula.

Topographic maps reveal that this process has gone on in various places in the chain also. Some of the larger islands are groups of small islands bonded together in this way. Hydrographic studies reveal very shallow passes between many of the islands, which will probably disappear with

➤ MAKUSHIN appears to have no distinct peak. Smoke issues constantly from the gigantic mound, which is visible miles at sea



➤ THE VENT OF MAKUSHIN emits steam and smoke from a number of places. This remarkable aerial photograph was taken in late summer, when the snow was lowest

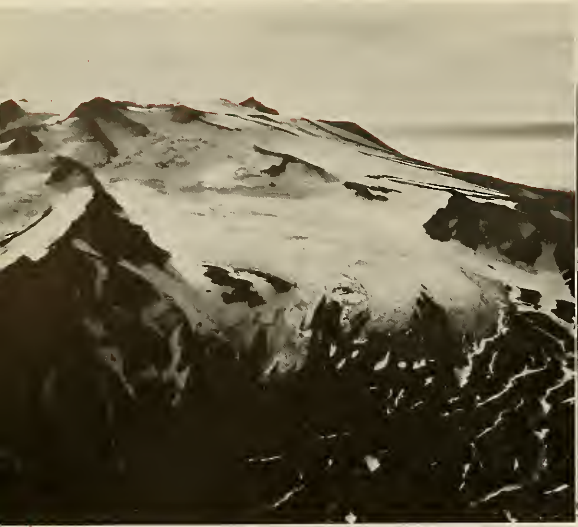


◄ PART OF MAKUSHIN'S GLACIAL SYSTEM. The area shown is about four miles wide

➤ IN WINTER, Makushin is completely covered, and the steam appears to be coming out of the snow a little more uplift, plus silting and the addition of material extruded or blown out of active vents in the vicinity.

The chain breaks naturally into five major subgroups, separated by the truly deep channels. They are, east to west: the Fox Islands, the Islands of the Four Mountains, the Andreanofs, the Rat and the Near Islands. The Russian Komandorskis form a sixth group, if added to their American relatives.

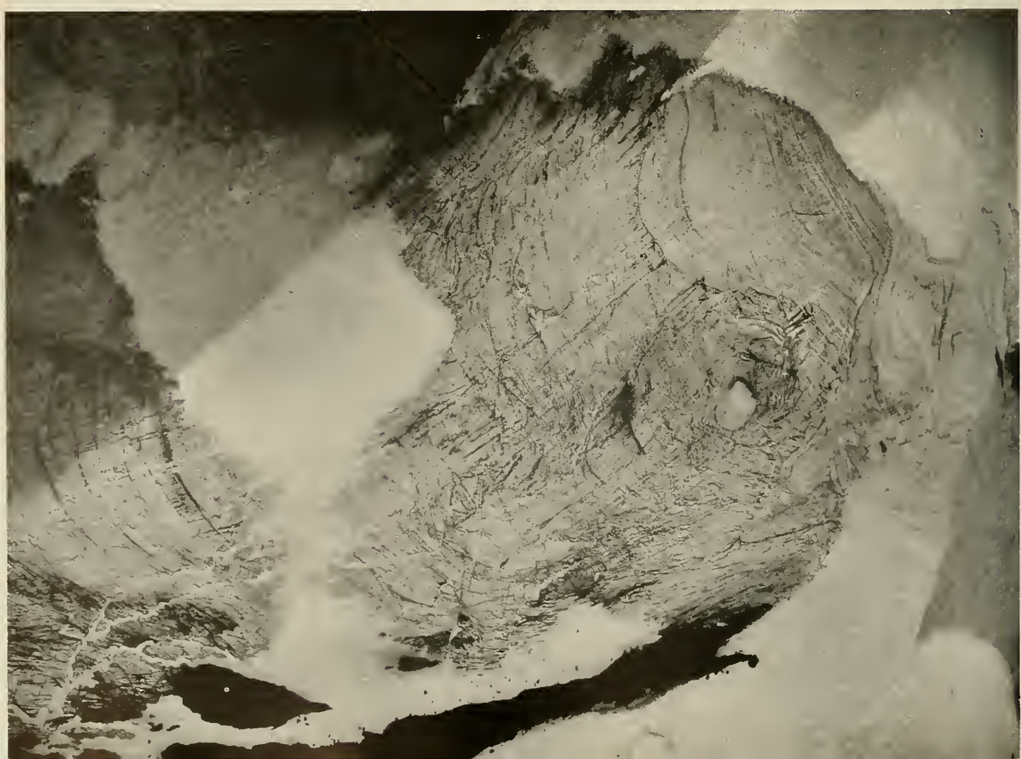
Probably the most spectacular place in the whole chain is the group called the Islands of the Four Mountains, which takes its name from the four perfect cones that dominate the area. Two of these, and several smaller ones, form complete islands in themselves, rising directly out of the sea. In winter they are completely covered with snow and look like giant morning-glory blossoms dropped face-down



▲ ICE FALLS, ICE CASCADES, and many branches of Makushin's glacier were exposed to view when the snows melted off in September, 1944

▲ ICE CLAWS AWAY AT A PEAK on the side of Mount Makushin, hollowing it out in what is known as a cirque

▼ CENTURIES-OLD CREVASSES AND FISSURES form a pattern resembling wood grain on this Makushin glacier, seen from the air



➤ **Mt. Cleveland**, "knee-deep" in a sea of clouds, shortly after its 1944 eruption. Mt. Carlisle is visible behind it to the northwest

▼ **Islands of the Four Mountains**, shortly after Mount Cleveland (smoking) erupted in June, 1944. Herbert Island crater is seen in the foreground. A blanket of fog hides the ocean

◂ **Jeep travel** requires relatively level ground, a good back to withstand the jouncing, and strong shoulders to do a lot of digging

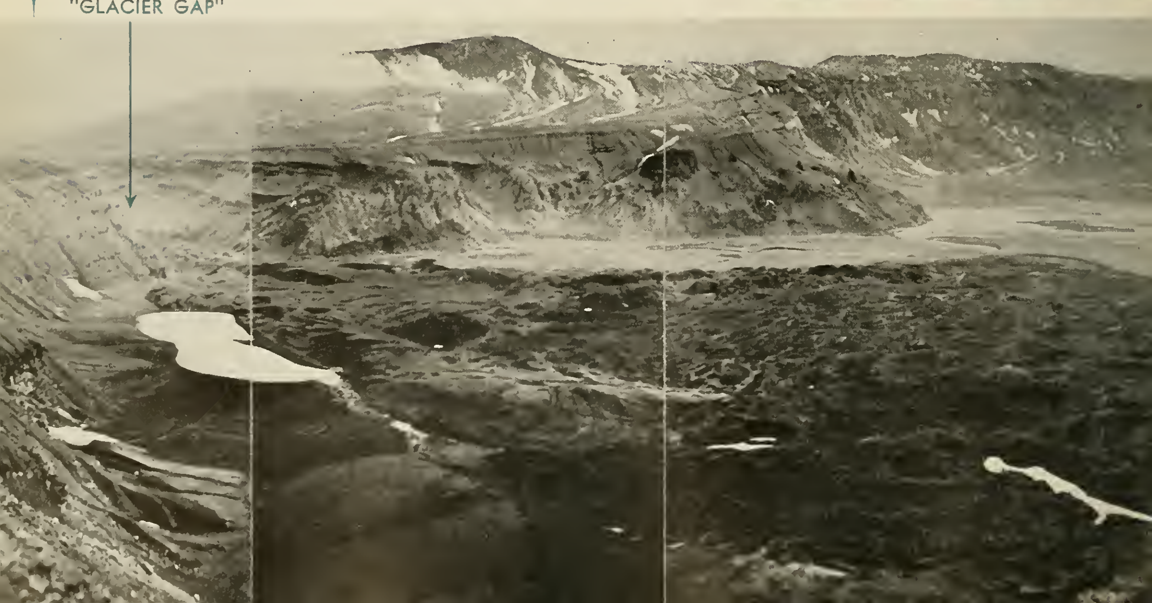
▾ **The plains of Umnak** are an ideal place for jeep travel, with weird igneous formations cropping up. This is the "Gateway" on the trail to Inanudak Bay

into the sea. In the spring and fall they lose all but the spectacular striping of snow that fills their ravines. In summer they are pretty drab, but even then they are interesting.

Akutan and Makushin Volcanoes are fairly well known. Before the war, a sulphur mine was in operation on Akutan. While its cone is only 4244 feet high, the crater is interesting. It has lost its top, either by explosion or subsidence, and the vent rises from near the center of the relatively flat floor. Hot springs bubble in the crater and flow out over the side through a small gap. Bright yellow patches mark the sulphur deposits on the floor.

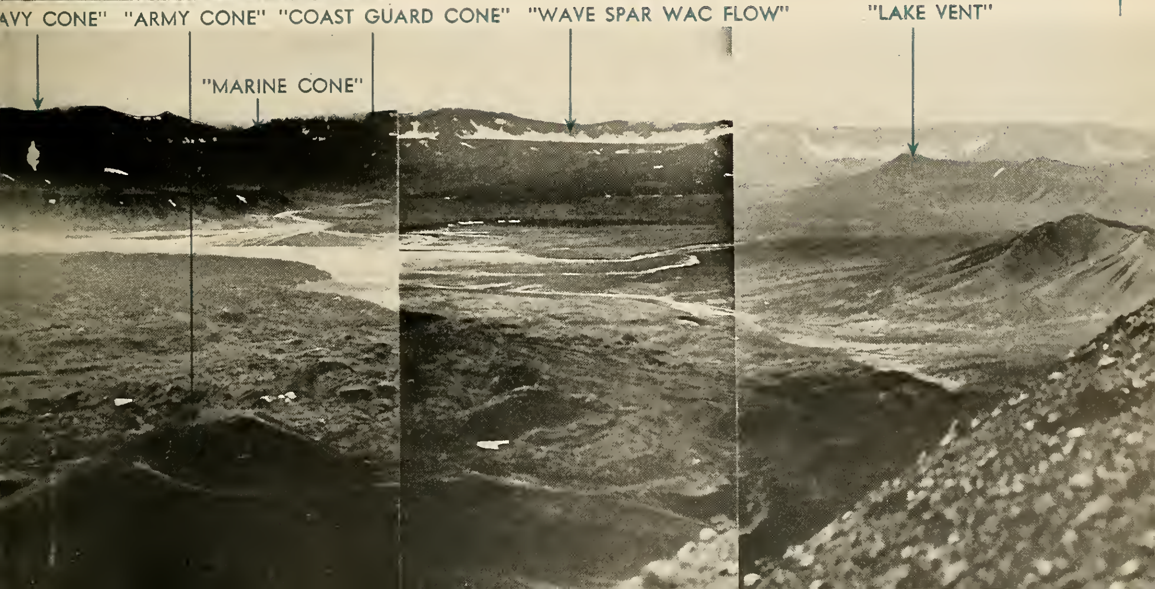
Makushin has a gigantic base but does not rise into a distinct cone. It is relatively rounded, except for abrupt slopes on the west side. It has a large glacial system that was clearly exposed to view from the air in 1944. An unusually warm summer melted the snow right down to the ice, and centuries-old crevasses and fissures were exposed in all their terrifying depth. For a week or two in September, ice cascades, huge ice falls, and the interrelationships of the many branches of the glacial system were fully exposed to view. For the first time in three years, it could be seen that Makushin had a true crater. For the snow had previously been piled so high on top that it appeared only to have several vents, off-center on a mounded structure. When the crater was revealed, it was quite similar to that of Akutan, with an off-center knob containing the vents, and with the crater marked out by a circle of cliffs.

The pictures of the glaciers on Makushin, taken by Marion Thornton, are important, because they are probably the first to show clearly the basic structure of an Aleutian glacial system. Stephen R. Capps mentioned glaciers on the Alaska Peninsula and evidence of past glaciation in the



▲ FIELD TRIP: part of the photo lab gang enjoying a picnic supper on a summer outing. Left to right: H. M. Thornton, of Blanchard, Washington; J. S. Siegfried, of Oak Harbor, Washington; W. F. Nichols of San Francisco, California; C. A. Prade, of Waco, Texas

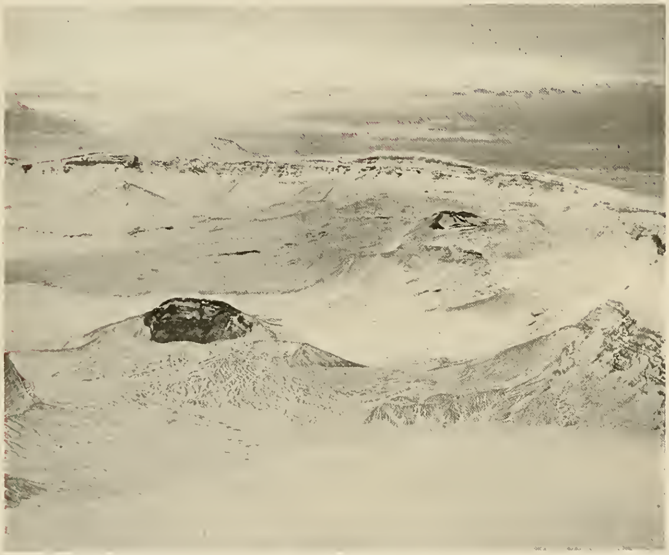
▼ NEWLY-DISCOVERED "ZOOMIE CRATER." This panorama shows the principal features as seen from the ground. There is a small portion missing in the center


AVY CONE"
"ARMY CONE"
"COAST GUARD CONE"
"MARINE CONE"
"WAVE SPAR WAC FLOW"
"LAKE VENT"

chain; but he did not state whether glaciation was still active. In the summer of 1943, glaciers were observed on Mount Vsevidof (6920 feet) and on an unnamed peak, which I have dubbed "Glacier" Peak (6510 feet), in the central portion of Umnak Island. Unfortunately, the light conditions weren't right for pictures, and those taken a few days later don't show much detail because of a light blanket of snow over the whole area. A trained eye can pick out the glaciers, however.

More beautiful shots of volcanoes were taken when Earl Robison had a chance to fly over Mount Cleveland shortly after its eruption in June, 1944. A few days before, it had been throwing up boulders "as big as pianos." Lava flowed down the sides, and aerial observation reported that a cloud of steam and ash was estimated to level-off at 15,000 to 20,000 feet.

One of the most interesting trips I had was by jeep on Umnak Island. We were recording some of the natural features for topographic studies. We bounced over mile after mile of tundra. The eastern part of Umnak has large areas of relatively flat ground that can be negotiated by jeep with the aid of shovels and a couple of strong backs. Travel is fine until you hit a marshy spot. Then the digging begins. We covered miles of ruggedly beautiful country exhibiting all kinds of odd igneous formations. At one place, a natural gateway leads between two isolated mounds that go almost straight up for several hundred feet.



▲ From the air, Zoomie Crater reveals activity. Melting on "Lake Vent" and in some areas of "Wave Spar Wac Flow" indicates that heat is still present. The difficulty of securing these remarkable photographs of the Aleutians will be fully sensed only by those familiar with the notorious weather of the region. It was estimated that Zoomie Crater, for instance, was invisible during all but about eleven days of the year

The crowning feature of the Umnak trip, however, was the jeep ride up to the rim of a giant craterlike basin, or caldera.* Reports had been reaching us of a crater large enough for airplanes to fly around in. It was said to be traversed by streams that flowed out over a high waterfall. It sounded fantastic, for there was no record of it anywhere, and the recent Hydrographic Survey Charts didn't show it. It was there, all right, eight miles in diameter, with walls 2800 feet high and rising 1500 feet from the floor. By following up the valley of the stream that flowed out of the U-shaped notch on one side in summer, it was possible to drive right up to the rim.

Once there, the view that greeted us was breath-taking. Spread out at our feet was a good-size river system that worked its way between five cinder cones. Several lava flows were clearly visible. One was still warm, for an aerial view showed the snow melted off a large part of it. Streams drained into the crater from all sides, adding to the volume of the rivers on the floor. The whole system drained out of the notch on the north side and flowed into Bering Sea. We followed the flow downstream and found a weird "hoodoo" area with oddly shaped rock formations, extending over a distance of several miles. We didn't have time to piece the whole story of their formation together, but the area was traversed by deep gullies that gave evidence of glaciation in their rounded grooving and in the presence of numerous erratic boulders with clearly defined markings.

Debris and ash are scattered for miles from the gigantic catacylsm that produced the caldera. To interpret the whole region would require a lot more time in the field than we had.

◄ The "hoodoo" area is deeply grooved by gullies. Here the glacier broke through the wall of Zoomie Crater and flowed out to Bering Sea

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* A caldera can be formed in two ways. It can result from a violent volcanic explosion that partially destroys the volcanic cone. Or it can result from subsidence of the lava in the pipe of the volcano, causing the cone to collapse into the void.

Roughly the story is this. After the explosion, glaciers filled the gaping hole, piling on layer after layer, until the outward force of the ice mass probed a weak spot in the rim. Here it burst through and cut the notch where the drainage leaves. The notch has been little altered by erosion and has the characteristic U-shape.

The valley that the stream follows is considerably wider than water action would carve in the time that has passed, and the lack of erosion on its slopes further indicates its glacial origin. The hoodoo area probably represents the deltal zone where the ice stream fanned out. Whether it is carved in a lava flow or in a maze of debris was not clear, and night was falling. We took our pictures in a miserable blowing rain that drenched us even through our foul-weather gear, and started back for the base.

It seemed unbelievable that the caldera had been unreported until military operations began in the area. Since it was probably first sighted by an Army or Navy pilot, we christened it "Zoomie Crater" and named the features of the floor after the various branches of the services.

Further observation revealed why it hadn't been previously discovered. From land or sea the only feature of it that was visible was Mount Tulik, a peak that rises from the rim on the Pacific side to an elevation of 4103 feet. This has been a landmark in the Aleutians for years. Tulik gives no hint of the crater, because it appears to build up gradually to a peak and seems self-sufficient from any angle on the ground or water.

It is possible that even the Aleuts didn't know "Zoomie Crater" was there. Their interests were principally with the sea rather than the land. They seldom traveled overland when they could avoid it; water offers the only convenient avenue for a primitive people in this country. Their village of Nikolski was miles away on the west end of the island. If, by chance, they knew of the crater, they probably had their remarks discounted because of their hazy use of the relative term "big," which could have been supposed to refer to Tulik.

The only way it could be spotted was from the air, and air operations were unheard of before the war. The U. S. Coast and Geodetic Survey charted Umnak's shore line, and the Navy Hydrographic Office made aerial traverses of it in 1935 and 1936, but a large blank area was left where the crater existed. Possibly the reason was overcast, for the crater is rarely clear. The peculiar air currents it generates usually fill it with clouds or fog, and even moderately clear weather is a rarity in the Aleutians.

The diameter of the crater as measured from the air was estimated to be six or seven miles. Subsequent surveys by Army Engineers indicate that in some directions the diameter is as much as eight miles. Points established on the north rim range from 2807 feet elevation to an even 3000 feet. Other points on the rim reach 3100 and 3310 feet. But the rim apparently dips to about 1300 feet where the brink of the waterfall offers an exit to the drainage-water of the basin. From this we can estimate that the floor in the level areas would probably average a little over 1500 feet.

Further studies that are being made of the crater will doubtless yield much additional information of interest, because this is certainly one of the largest formations of its kind in the world.

▲ U-SHAPED VALLEYS give evidence of the part glaciation has played. Unalaska Island

➤ TWO-THOUSAND-FOOT CLIFFS are common on the sides exposed to the sea. Unalaska Island near Inanudak Strait

NIGHT MUSIC

By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

WHETHER we live in city, town, or country, most of us have often heard the nighttime serenading of cats. It is a wild sound, uttered with such intensity of feeling that it would be frightening if we did not know the animals that thus express their longings. The sounds are far from pleasing to our taste, but they have all the qualities of great music except beauty. Clarence Day, in his revealing book of some years ago, *This Simian World,* suggests that had cats become the dominant animals and developed a feline mentality comparable with that of man, they might have valued the arts more highly than we do, especially the art of music. Imagine how sublimely a feline opera star would have been able to sing.

Caterwaulings (crying of cats) are produced in the same way as the songs of human beings, by the combined action of the vocal cords in the larynx or voice box, the tongue, the lips, and the throat. The sounds are not hard to imitate, some of them being very similar to the wailing of a baby, the cry of a person in agony, or the screech of an excited member of a mob. The sounds given out by courting cats are different from those used by antagonistic members of the same sex. The quarreling duets are sung in a different key, and different "cat-words" are used—vocalizations which have been anglicized as *ah, aah, ooh, waa, wah, wow,* and *yah,* in various combinations, mingled with spitting and hissing sounds, screams and screeches. Sometimes the vocal conflict may end in a truce, but often the rival cats resort to clawing and scratching that work havoc with ears and noses.

Still other sounds and voices are given out when a cat is hungry and begs for food. Miaowing is the descriptive name for this language and resembles a half-spoken, half-sung line somewhat like that used by certain radio and night club entertainers.

The growl is another kind of "cat-language," shared with all or most members of the great order of flesh-eaters, or carnivores. A warning growl given by a mother cat will cause her kittens to hide. Other growls warn rivals away from food.

The purring of a cat is much like the humming of human beings, but while we hum almost exclusively during exhaling, a cat purrs both during intake and expulsion of the breath. The air as it is drawn in and forced out passes through the larynx, or voice box. Here the cat has two pairs of vocal cords, whose tension is regulated by muscles. The cords vibrate strongly, and their vibration is transferred to the larynx and often to the entire rib-basket, which trembles in time with the purr. Purring is, of course, the cat's way of expressing contentment and pleasure. Kittens begin to purr at an early age, as young as nine days. At first they purr in a single note, but adults develop two notes, often connected by a slurring intermediate one. The larger cats—lion, tiger, leopard, and mountain lion—purr when contented, at least in captivity. Their purring is vigorous and loud, like the whirring of a powerful machine.

Our decorative yuletide plant has ancient roots in the lore of the Old World. Its cousins in America have left a strong imprint on Indian life and provided the world with one of its foremost beverages

HOLLY

By BETTY WILSON HIGINBOTHAM

A.M.N.H. photo

AMERICAN HOLLY (*Ilex opàca*)

As our European forefathers, merry with wassail, cavorted about in search of branches of holly for their yuletide festivities, they little dreamed that on distant and still undiscovered American shores the Indians were gathering holly for the purpose of garnishing their alimentary interiors with its potent properties.

Not having heard of Columbus or America, our ancestors blithely decked their homes with boughs of holly and kept alive a custom far older than Christmas itself, a tradition begun long before the birth of Christ. The Romans in their midwinter festival, the Saturnalia, not only adorned their halls with holly but exchanged gifts decorated with sprigs of holly. Because of its association with this pagan rite, the use of holly in Christian ceremonies was frowned upon by the early church, but holly has survived all the changes of religion, time, and custom, and its influence and roots have even spread into countries where it was unknown before.

Completely outgrowing its old association with the Saturnalia, holly became known in some countries as Christ's Thorn and has been associated with the crucifixion as symbolic of the crown of thorns, the scarlet berries representing drops of blood.

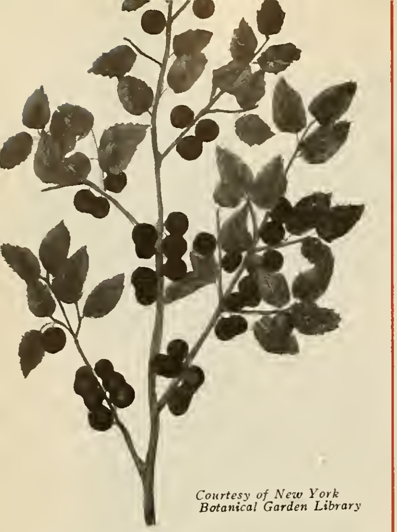
In old English, holly was called holm or hulver bush, and an early Lenten custom of the French and English included the making of effigies of a boy and a girl dressed in holly and ivy. The holly boy and ivy girl were paraded through the streets and then, with proper ceremony, burned. This custom has been interpreted as being a sort of official closing of the new year season and opening of the spring or Lenten season.

It is interesting to note that some holly trees are entirely male in sex, and the early Lenten celebrants seem to have been cognizant of this. Male hollies produce no berries, of course, much to the chagrin of some holly planters; but fortunately the holly usually produces both male and female flowers on the same tree, thus ensuring fruitfulness.

Perhaps because of its close relationship with the Christian holy season of Christmas, holly acquired the reputation of a thing of terror against the forces of evil. Witches in particular feared this plant as they feared an angel, and a holly tree planted beside a house safeguarded it from the machinations of wicked spirits. The efficacy of a lone holly tree might today be doubted, but there is no question that a holly hedge can bar the way of man or beast. Whether for this reason or for its beauty, or both, holly hedges are popular in England.

No doubt to recompense for its hostility toward evil spirits, holly was said to have received divine intervention from the depredations of cattle. The intervention consisted of having its lower leaves armed with sharp prickles which safeguarded it from hungry cows, while the upper, out-of-reach leaves remain defenseless. Southey refers to this characteristic of holly in one of his poems:

> Below, a circling fence, its leaves are seen
> Wrinkled and keen;
> No grazing cattle through their prickly round
> Can reach to wound;
> But as they grow where nothing is to fear,
> Smooth and unarm'd the pointless leaves appear.



Courtesy of New York Botanical Garden Library

▲ ANOTHER MEMBER of the holly genus: the source of the "black drink" which had ceremonial significance among the North American Indians (*Ilex vomitoria*)

This peculiarity is common to both the English and the American holly, which can scarcely be distinguished by the layman except by the slightly less brilliant berries on the American holly. Both species are cultivated in this country, but the American holly also grows wild in the eastern half of the United States, that is, where it hasn't been killed off by holiday garland seekers.

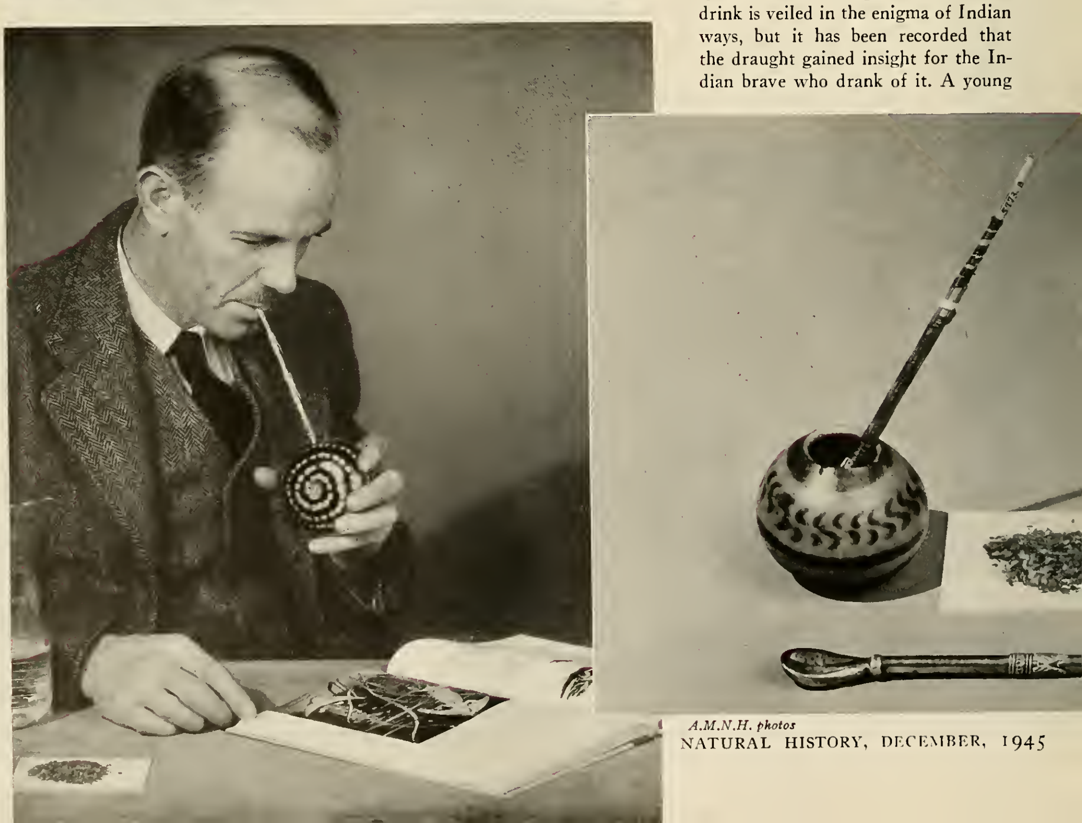
The holly's ability to protect its lower leaves may have given it the meaning of foresight in the Language of Flowers. The Language of Flowers, apparently now one of the dead languages, formerly provided a means of sending messages to genteel ladies,—messages discreet, diplomatic, or otherwise, since practically any thought a lover might wish to convey could be sent without putting down a word in black and white. Several books were published giving the "code" words for the flowers. Using the floral dictionary, one would learn that a bouquet of heath and pansies meant, "My heart would be at ease, if my solitude were blest with your society," or that a single dried white rose conveyed the poignant thought that "Death is preferable to the loss of innocence." In like manner holly, which stands for foresight, might be included in a bouquet of lily of the valley and filbert to signify, "I foresee a return of happiness with our reconciliation."

While the American and the English hollies are the species commonly meant by the term "holly," there are other species of holly that have an equally colorful history and appearance, and one is of economic importance.

The yaupon (pronounced YO-pon) is a holly that was highly esteemed by the Indians, so much so that whole tribes would migrate in the spring to southern coastal areas where they could find the shrub in abundance. This plant cannot be said to resemble holly closely, but it does belong to the same genus as our familiar yuletide variety.

The purpose of these treks was the preparation of a beverage called "black drink," often mentioned by early explorers and travelers. The potion, made from yaupon leaves, was mysterious and ceremonious, though in a somewhat different way from the peace pipe, with its smoke blown to the four winds and to the Great Spirit. From this black drink came the power of foresight—a coincidence tying in with the Language of Flowers though far separated from it in time and space. The full significance of the drink is veiled in the enigma of Indian ways, but it has been recorded that the draught gained insight for the Indian brave who drank of it. A young

▼ A THIRD SPECIES of holly supplies some 25 million persons with their customary beverage, maté. It is brewed in a gourd more or less like tea and is sipped through a silver or reed tube



A.M.N.H. photos

Indian boy just coming of age was introduced to manhood and to the black drink at one and the same time. In preparation for his induction into adult life the Indian was put through purification rites that included drinking the beverage. If the youth was not purified spiritually he was most certainly thoroughly cleansed physically for in strong doses the drink is both an emetic and a purgative. If the poor lad were not too preoccupied with these physical reactions, he too may have had visions, not one of which, let us hope, was an insight into the sad fate of the race. Sometimes Indians drank of this concoction simply for the medicinal effect, and occasionally a weak infusion was used as a beverage.

Although early colonists at one time adopted yaupon as both a tea and a medicine, today its potency is forgotten and its chief glory is its beauty.

In the southeastern states where it is native, yaupon (called by botanists, realistically, *Ilex vomitoria*) is common in the gardens and yards of homes, where its rich evergreen leaves and abundant scarlet berries are conspicuous in the wintertime. Branches from the wild thickets are popular for Christmas decorations.

In America before the time of Columbus, most members of our holly family took the place of beverages obtained at our modern roadside stands and offered the makings of a spot of tea to the Indian, who seemed to relish his "tea" as much as the Englishman. And it might be mentioned that a recent book on plants claims that yaupon is the best native "tea plant" we have. Yaupon's reputation would not encourage one to experiment with a strong dose. But it is rather extraordinary that so many species of holly have been used for tea over such a wide area and before there was any communication between these lands, particularly when the berries of most are considered poisonous.

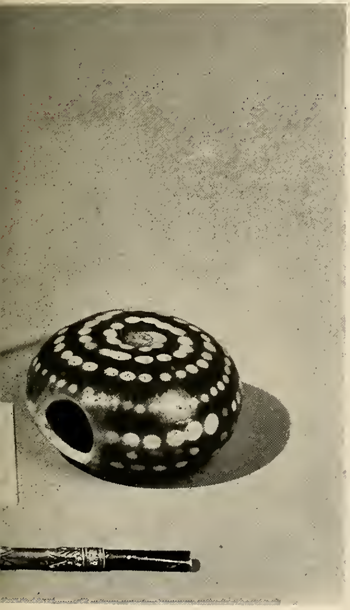
In North America the Indians, and later the colonists, made drinks from the yaupon, dahoon, common winterberry, inkberry, and the American holly, all members of the holly genus. In England a tea and a medicine were formerly extracted from the English holly. But it is in South America that one of the hollies has reached its greatest importance as a beverage. Yerba maté was in wide use when the European invaders first arrived. The natives had probably been drinking this tea over a very long period of time. This species of holly had endured the changes of time, custom, and race; and the white man even found himself converted to its use and furthered its growth in well-tended plantations. Today, yerba maté has become an article of considerable commercial importance.

Yerba maté, or Paraguay tea, is obtained from several species of holly but mostly from *Ilex paraguayensis*. As usual with infusions from holly leaves, we find the beverage is a stimulant.

The brewing of maté is similar to that of our tea. The leaves are dried and broken into small flakes. The beverage is drunk through a tube, usually silver, called a bombilla, which has a small perforated bulb at the base serving to strain out the leaves. Maté is exported from the countries that produce it (chiefly Paraguay and Brazil) and is to many South Americans what coffee is to North Americans. In the United States maté is seldom seen except in the markets of our larger cities.

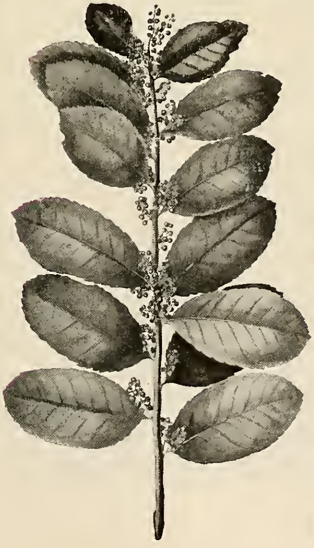
In spite of all of its medicinal, mystical, and potable possibilities, the safest thing to do with your Christmas holly this year is to hang it up and admire it from a distance; any of its other uses may yield more or less violent results.

▼ THE SIPPING TUBE has either a perforated bulb or a woven strainer at the lower end to sift out the leaves



▼ A SPRIG of the plant from whose leaves maté is made

New York Botanical Garden



▼ THE "MATÉ TREE" develops a well-rounded head in the natural state. Under cultivation the quality of the tea improves, but the plant remains a small shrub with many stems

Photo from Ewing Galloway

PETRIFIED FOREST
NATIONAL MONUMENT
HEADQUARTERS → 20
ST. JOHN'S → 64
GATES OPENED 8:00 AM
GATES CLOSED 7:00 PM
NAL PARK SERVICE

◄ **GATEWAY** to a world of long ago

The rainbow-tinted logs of the Petrified Forest tell a fascinating tale from the days before the dinosaurs

FORESTS OF STONE

By JOYCE AND JOSEPH MUENCH

All photos by the authors

When the world was younger by some 200 million years, there was a great valley covering a large part of what is now southwestern United States. It was flanked on the east by the forerunners of the modern Rockies, and there was another incredibly old range to the southwest. A long plain sloped clear to the Pacific Ocean.

It was the age when the long reign of the dinosaurs was just beginning. Giant crocodile-like reptiles known as phytosaurs lived along the rivers and lakes. In a warm and temperate or subtropical climate, thick jungle-like forests margined the streams. These were the trees that were to be transformed into the stone giants we see today in Petrified Forest National Monument. They were conifers, related to our modern pines but more like the araucarian pines of South America and Australia.

After many of the trees had died, floods buried them in silt. In time they were covered with 1000 feet or more of rock, some of it laid down as sediment, some as volcanic ash. Percolating waters, carrying various chemicals, gradually transformed the trees to stone.

The Rockies and the Sierras were pushed up into place, and the plateau was lifted with them. The trees, though still far below the surface, were now high above sea level. It was this great uplift that permitted them to be uncovered by the action of streams and other agencies of erosion—the same that carved out the Grand Canyon. This vast erosion occurred only within the past million years or so.

What happened to the trees while they lay for many millions of years under the earth? It has generally been thought that all the material of their original cell structure was dissolved out and replaced by silica. Recently, however, evidence has been presented indicating that if one dissolves the silica out of a piece of petrified wood, the structure remains unchanged and merely becomes soft so that it can be crushed between the fingers.* Just as seaweed can absorb more salt than is to be found in the water surrounding it, the wood of the submerged trees apparently absorbed silica, iron, and other miner-

➤ **POLISHED AGATE**: a section cut from a petrified tree. Rougher pieces of ancient trees support it. In the Petrified Forest National Monument there are six whole forests of petrified trees

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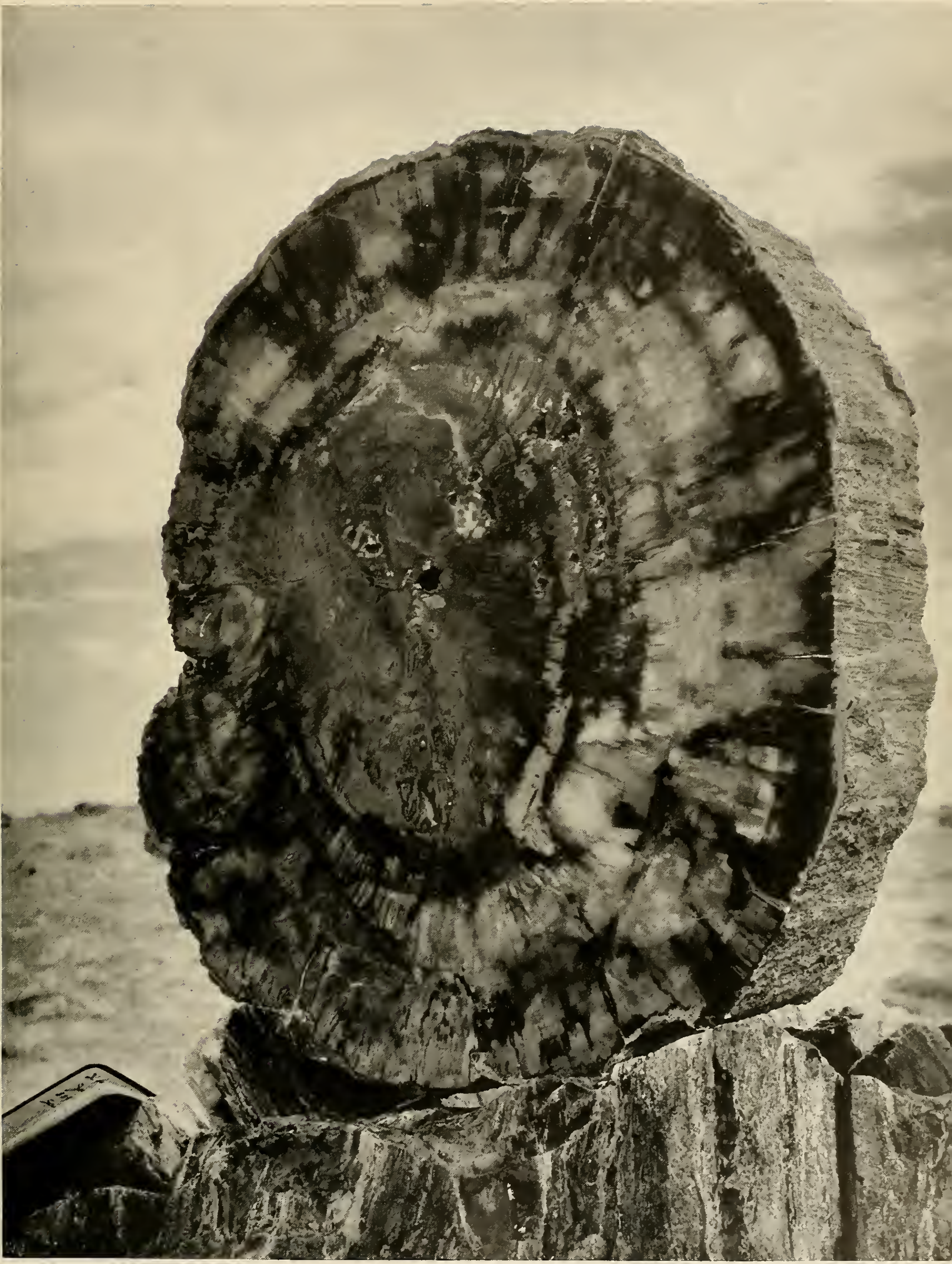
*See "Changing Views of Petrification," by William G. Darrah (*The Pan-American Geologist*, August, 1941), and "The Petrification of Wood," by Chester A. Arnold (*The Mineralogist*, September, 1941).

The writer wishes to acknowledge the kind help of Mr. Floyd L. Keller, Park Naturalist, in preparing this article.



als, without losing all of the woody structure. These chemicals pushed into the intercellular spaces and into cell cavities where some decomposition had already taken place. Iron oxide gave the petrified wood its red shades, manganese oxide its darker hues.

The early Spaniards apparently never saw this area, with its giant trees of rock. It was not until 300 years after Coronado had visited the Southwest that official notice was taken of them. Lt. Sitgreaves reported finding the forest in 1851. When the Santa Fe Railroad (then the Atlantic and Pacific) was thrown across Arizona and completed in 1883, settlement began. More and more people heard about and saw this surprising spectacle. There was a scurry to collect the semiprecious stones for jewelry, and one company set up a cutting and polishing laboratory with the purpose of selling sections for table tops and desk fixtures. It would not have taken long to destroy all this marvelous work of the ages. Fortunately, the threat was averted in 1906 with the creation of the Petrified Forest National Monument.

The following years added to the discoveries, and the protected area was enlarged. John Muir, the celebrated naturalist, found and named the "Blue Forest" in 1906. In 1911 the Agate Bridge, a petrified log spanning a 30-foot ravine, was strengthened by stone pillars. This great tree is 111 feet long in its exposed portion and forms a natural bridge 40 feet long.

In 1930 the Blue Forest and Newspaper Rock were added to the Monument. Newspaper Rock includes some of the petroglyphs, or rock carvings, found on the sandstone cliffs along the western side of the Monument. These, together with Agate House and various other ruins speak of the early people who lived among the petrified logs from about A.D. 500 to about A.D. 1400. They used the petrified wood as building material as well as for tools and weapons.

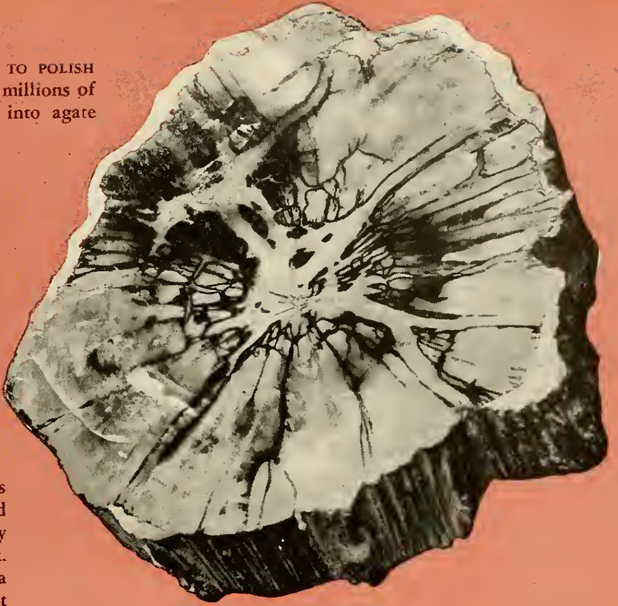
What the early people who inhabited this region thought of the petrified forest, we may never know; but the modern Indian has several stories. One tells how a goddess wandered into the forest, cold and hungry, exhausted from travel. With one swift blow of her club, she killed a rabbit and prepared to cook it. But the logs were wet and would not burn. In a rage of disappointment, she turned them all to stone so that they could never burn.

The Paiutes say that the logs are broken weapons of the Wolf God. These are the battlefields on which he waged war, and by the size of his weapons you can know the strength and ferocity he must have possessed.

The Navahos tell a third story. To them, this is the burial ground of a dreadful monster whose name was

▼ **Logs like these** are found in the Second Forest of the Petrified Forest National Monument. They are the petrified remains of ancient trees that were buried deep in the ground and ages later uncovered by erosion

➤ IT MAY HAVE SEEMED A BIG JOB TO POLISH a piece like this, but it took Nature millions of years to transform the living tree into agate

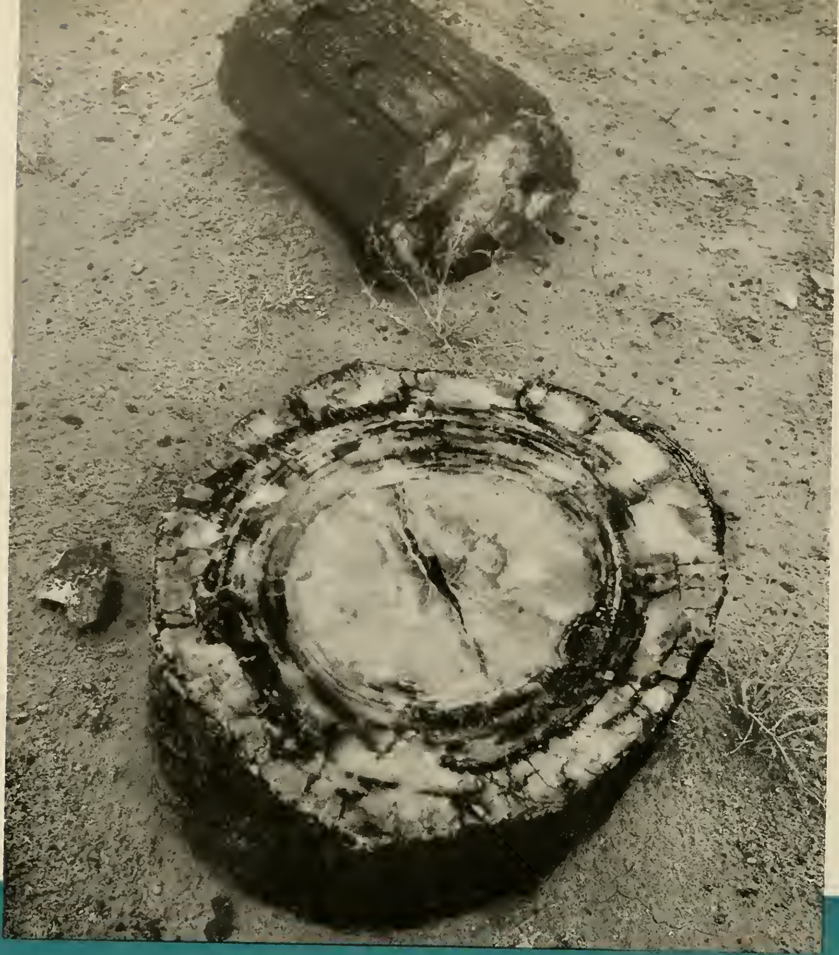


➤ APPROXIMATELY 200 million years ago this was a living tree. At the end of its life, it fell and was covered by deep layers of earth and rock. Changes took place within it over a long period of time, transforming it into beautifully colored stone

Yeitso. He was destroyed by the Sun God, and these are his bones.

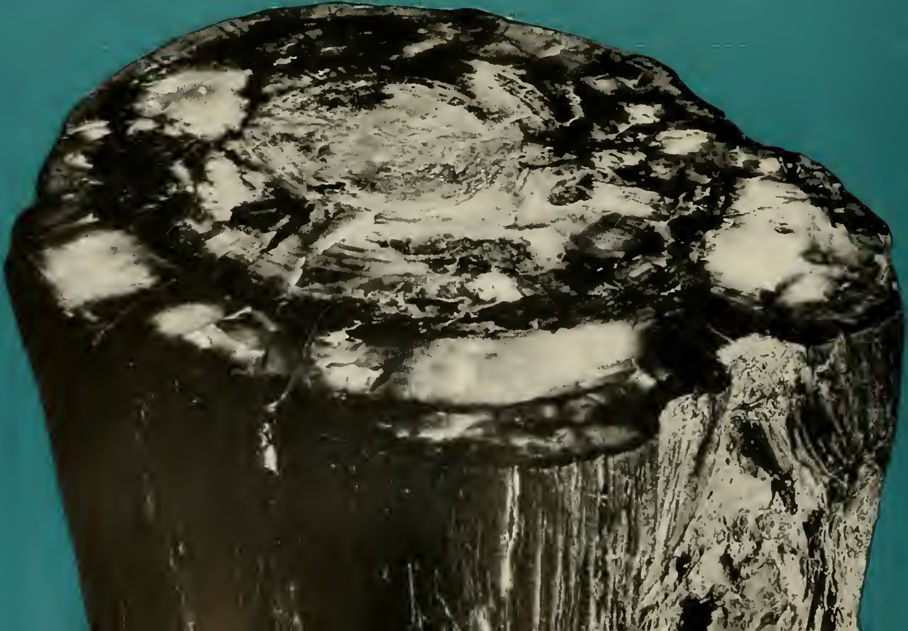
Petrified wood has been found in various parts of the world. In the coal measures of England an old forest was uncovered. Yellowstone has some fine examples, and Napa County in California boasts some large trees of long ago, to mention only a few. But in northeastern Arizona is the most colorful display to be found in the world. Besides all the petrified logs that lie on the surface, eroded into view after an amazing life history, there is reason to believe that many more lie still buried, waiting the magic wand that time is sure to wave over them.

Northwest of the Petrified Forest lies the beautiful Painted Desert, a fantastic area of canyons and mesas, where colors run riot and the landscape is banded with shades of purple, red, and yellow. This section was added to the Monument by President Hoover in 1932. Now a little over 90,000 acres are under the Park Service, with six separate forests. All of these but one are within reach of the motorist, being only a short walk from parking areas. The Black Forest is well beyond the rim of the Painted Desert and is accessible as yet only by trail.

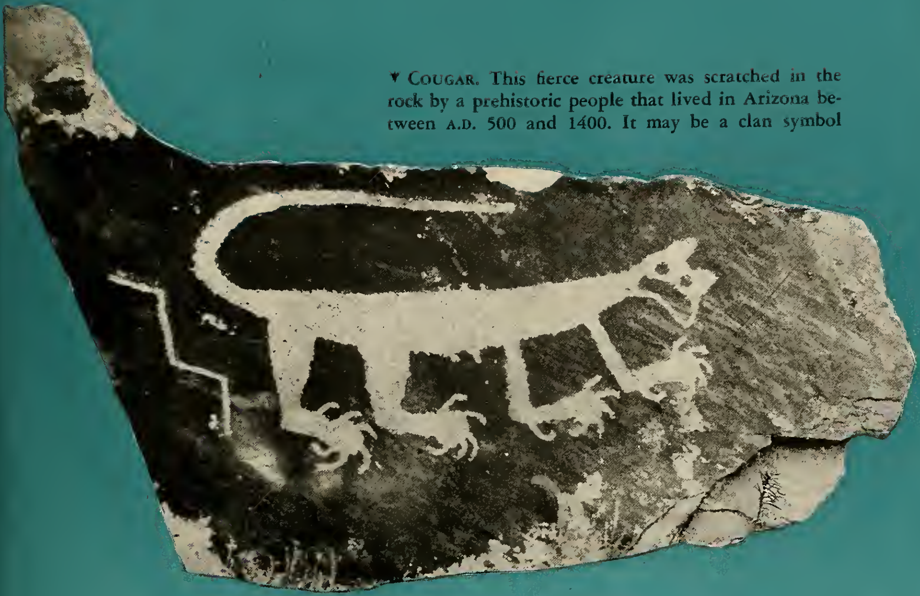


◄ A LOG OF TRANSLUCENT AGATE. Far back in the days of the dinosaurs, these trees fell and were buried. Silica in solution and the stain of other minerals entered their intercellular spaces and cell cavities, giving them the beautiful colors for which petrified wood is famous

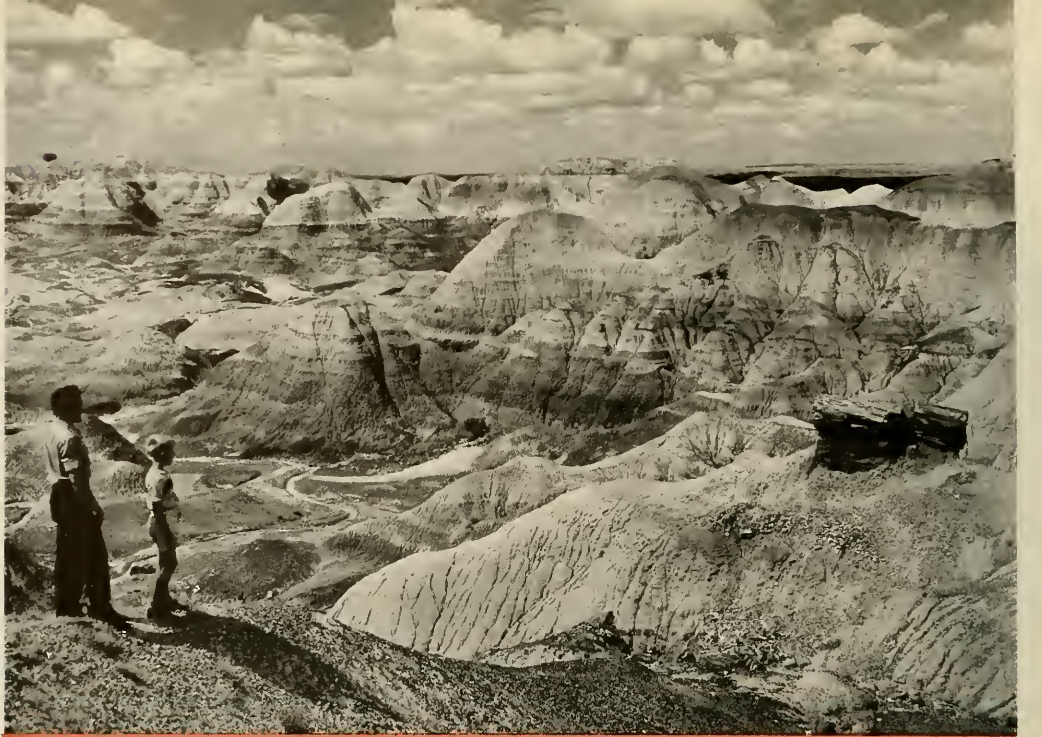
▼ THIS HIGHLY POLISHED BLOCK of agate shows the structure of the tree it once was. It was to save pieces like this from destruction that the Petrified Forest National Monument was created in 1906



▼ COUGAR. This fierce creature was scratched in the rock by a prehistoric people that lived in Arizona between A.D. 500 and 1400. It may be a clan symbol

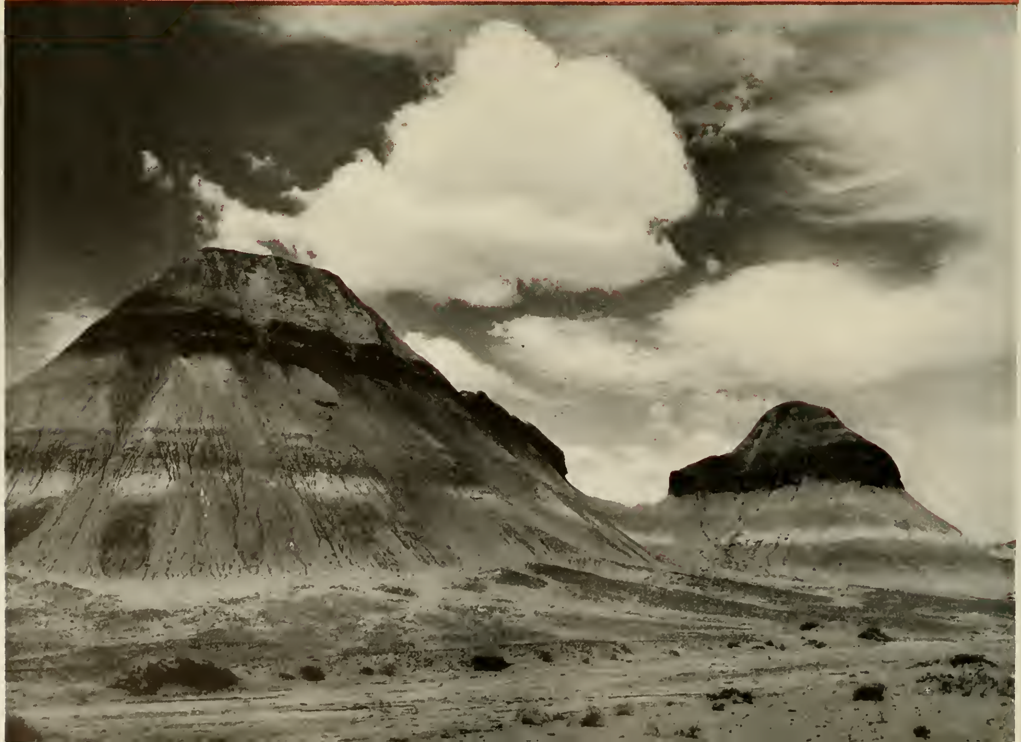


▼ PAINTED DESERT. Lying northwest of the Petrified Forest, this section was added to the Petrified Forest National Monument by President Hoover in 1931. Now a little over 90,000 acres are under the jurisdiction of the Park Services in the Petrified Forest area



▲ **Wonderland in the desert.** Rainbow hues enliven the landscape along this portion of the Blue Forest road. The petrified tree at the right is balanced on a base that is slowly being eroded away

▼ **The "Giant tepees"** are among the strange shapes cut from the alternating layers of bentonitic clay and sandstone in the Petrified Forest National Monument. When dry, the disintegrated clay is hard, so the tepees keep their form between the infrequent rains



The Jumping Spider

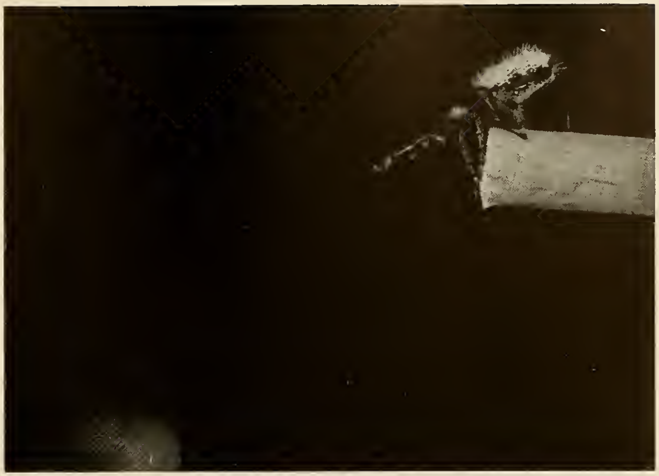
Photographed in action at 1/30,000 of a second

By WALKER VAN RIPER

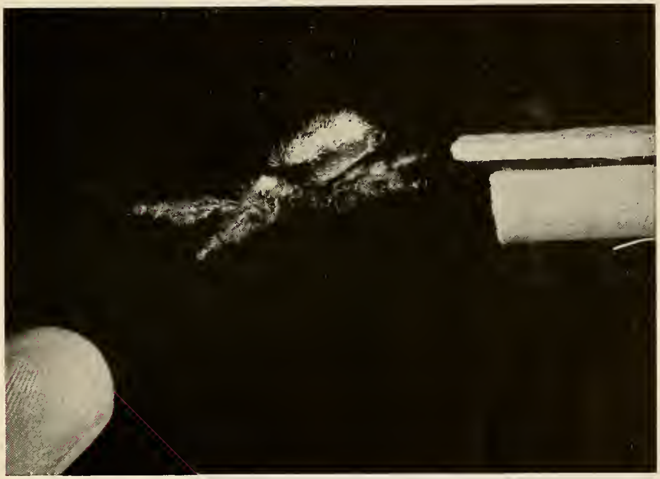
Curator of Spiders,
Colorado Museum of Natural History

A NUMBER of naturalists have been interested in the behavior of the jumping spiders, or Attidae. Various methods have been employed to determine just how they jump, but the action is too quick to be observed accurately by the unaided human eye. Photography with a high-speed flash brings out every detail not only of the act of jumping, but of the use of the safety-line as well. The accompanying pictures were taken at about 1/30,000 second with a homemade high-speed flash.

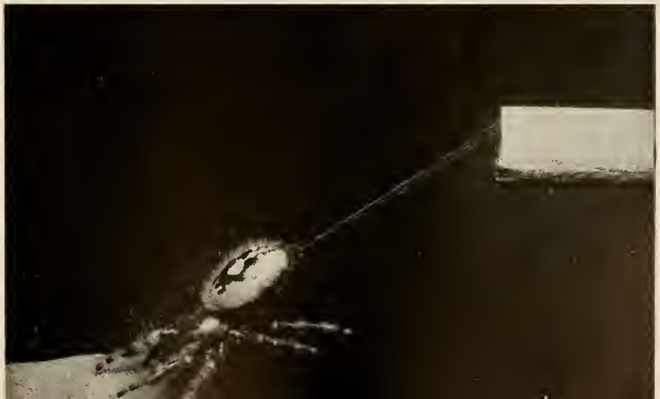
The shot of the spider in mid-air presented difficulties. Snap shooting wasted a lot of film. Finally a springboard was devised so that when the spider jumped, a contact was made which closed the circuit and flashed the light. The spider was kept in place by putting a ring of vaseline on the perch behind it and a pan of water beneath. Then, with the room in semi-darkness except for a little light on the finger to which the spider was to jump, the creature could be prompted by a little teasing to leap almost at will.



▲ "ONE FOR THE MONEY." Jumping spider getting ready to jump, with the safety-line attached behind. Actual length of spider is ¾ inch



▲ "FLYING through the air with the greatest of ease"



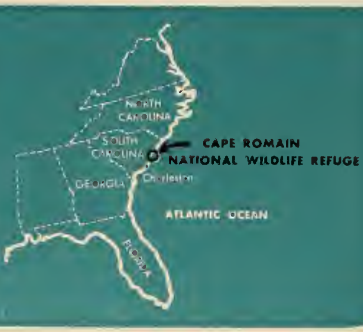
➤ LANDING. The safety-line, as it emerges from the spinnerets, is made up of a number of filaments which coalesce and harden on exposure to the air. If the spider misses, the safety-line enables it to haul itself back up to the perch

Wildlife Refuge

By Grace E. Barstow Murphy*

A Christmas visit to one of Nature's island sanctuaries—where the majesty of wildlife is preserved by those who see that steel and stone are not enough to make a nation great

▲ *Ornithologus americanus,* represented by Bob and Amos, were transient fauna on Bull's Island



Seventy thousand ducks! And every one of them protected by the Government of the United States! Mallards, black ducks, baldpates, pintails, blue-winged teal, green-winged teal, shovelers, ruddies, scaup, canvas-back, and wood ducks fly out of every waterway. They fill every vista. They practically pose for the amateur who wants to learn one from another.

Such is the Cape Romain National Wildlife Refuge, one of the larger of the 279 sanctuaries maintained by the Fish and Wildlife Service. This refuge, north of Charleston, South Carolina, is a six-mile-wide strip of land, marsh, and islands stretching for 21 miles along the coast and embracing 28,000 acres.

My husband, my son Amos, and I passed the Christmas holidays there last year. A launch waited to carry us through the channels to Bull's Island, where 5000 acres hold as thrilling a natural history experience as can be found. This and the other sanctuaries are helping to see that bird populations are protected and increasing, and that the natural beauty of our countryside will be preserved. The wild turkey was a symbol of the unspoiled land of our forefathers. Wild turkeys would have become extinct had they not been protected. One hardly walks a road at Bull's Island without seeing a turkey or two. I soon saw exactly what I had wanted: a huge cock flying from the road to the top of a tall tree, his great wings lifting his heavy body lightly. The iridescence of his back shone in the sun, and the colors of his wings, tan at the tips, were completely clear.

Crab grass, wild rice, and various legumes are planted for the turkeys, and the kind of open space they like is provided for them, so that they will multiply. I went with Mr. Waring Hills, the Refuge Aid, to bait the traps, which is not the sanguinary proceeding it sounds. Corn was placed in wire enclosures that looked like natural clumps of palm or shrub. When the turkey goes in, the trapper in the blind pulls the string and the door falls. The bird is then banded and may be shipped to another refuge and there released.

The up-turn for geese

Five years ago there were 16 Canada geese on the refuge. When we were there last winter there were 200—and one lone snow goose. Soon there will be more. The proper food is now growing, and they come to get it. Their calling could be heard at night. Mr. William P. Baldwin, the Manager, took us in the launch to Cape Island to see them. We counted flocks totaling probably 150 birds. One flock of about a dozen, looking like gray, feathery balls, was asleep down on the beach. One after another the birds woke up and stretched their long, graceful necks as I watched through the glasses. Then each in turn, fearing nothing, settled down with head under wing.

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* As readers of Natural History will recall, the wife of Dr. Robert Cushman Murphy, head of the Department of Birds at the American Museum, shares keenly her husband's absorption in the living cosmos that is our natural environment. They have made many trips together with various scientific objectives, and her poetic interpretation of nature has expressed itself in a number of articles in this and other magazines. Not long before the experiences in South Carolina she describes in this article, she traveled by airplane to Ecuador ("Flight to Ecuador," Natural History for September, 1943), and more recently she visited Venezuela. —Ed.

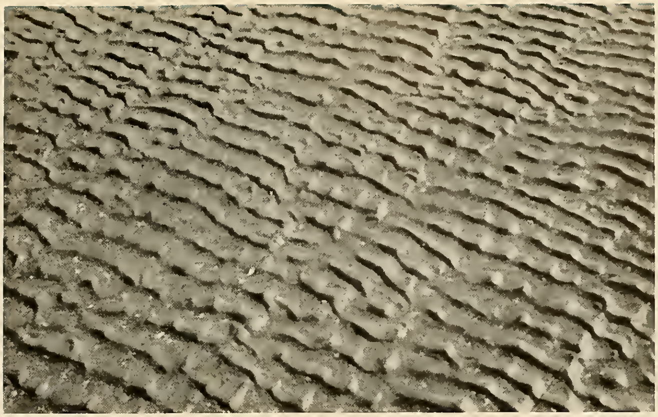
The refuge is the northernmost home of the brown pelican, which breeds there in large colonies, sometimes 300-strong.

The range of research in conservation carried on at the refuge, as viewed through Mr. Baldwin's *Quarterly Narrative Reports,* is staggering to the outsider. The whole bird and mammal population is covered, including their relation to each other and to the plant life of the region. Every fact of weather and every change in the vegetation must be at the fingertips of the man responsible for all that is happening in this sample of wilderness. For wilderness it is, with the natural flora and fauna as they were 300 years ago, yet directed, in infinite patience, by skillful and accurate scientific knowledge.

Not content with the full-size job of daily surveys and reportings and recordings, Mr. Baldwin has made many specific studies in the refuge. He spent four months on the beach of Cape Island observing the enormous loggerhead turtles and writing a paper on them. Great numbers of them, some weighing 250 pounds each, come there in summer from tropical oceans and lay their eggs, which, Mr. Baldwin says, is an awesome thing to watch. He had a Roman holiday when 65 blackfish, 8 to 17 feet long, were washed ashore and died. It was an unusual opportunity, and the beach was for the time an outdoor anatomical laboratory. These small whales were studied inside and out, even to the unborn young. But the work had to be rapid, because 65 large animals rotting on a hot beach presented problems that were not alluring even to the most enthusiastic scientific man, in spite of help from the black vultures. Mr. Baldwin's "Notes on the Vegetation," which include careful botanical maps drawn to scale, are a study of every bit of growth in the whole refuge. We are told that "wild rice appears to be spreading"; and the differences between the mainland and the island vegetation are explained, with data on the soil and growing conditions. All desirable species are encouraged, not only for themselves but also for help in crowding out the undesirables, such as cord grass and cattail.

Wildlife careers

I mention Mr. Baldwin's work partly because it seems that there is a new and growing opportunity for



▲ **Ripple marks** at tide-line were sculptured in the sand

▲ **A banded scaup duck,** released to carry the message of its age and migratory travels to some other ornithologist—if it falls to a gunner or ever again blunders into a duck trap

▲ **Ducks** in the tail of the trap become frantic before they are seized but seem to calm down once in the hand. They rarely struggle while the numbered band of the United States Fish and Wildlife Service is being attached to one leg our young people in a most interesting profession. In 279 wildlife refuges, with jobs for the two types of naturalists—those who conduct serious research and those who apply these studies in refuge management—it looks as though there are careers which could bring the utmost satisfacto a great many young people.

Bull's Island used to be a shooting preserve; now it is a haven for wildlife, sold at a fraction of its value to the Government for the cause of conservation by Mr. and Mrs. Gayer Dominick.

Dominick House, originally the Lodge, is located in a clearing near the boat landing. It has big rooms, plenty of beds and open fires, and is now in the charge of Mr. and Mrs. Hills. Mrs. Hills plans wonderful meals which could easily increase one's girth. There are so many oysters and fish near-by that the Hills practically whistle them into the kitchen for Anna, the maid, to cook. Mr. Hills knows every bird and beast and tree on the island and is ready to share his knowledge.

On the Cape Island trip we located clams in the sand by their little "keyholes" and used shells to dig them. Later we ate them in front of the Baldwin's fire.

Bird banding

Bird-banding has always been a major interest, naturally. Birds that have been tagged and numbered have been picked up again all the way from Canada to Florida. Shortage in personnel and in metal bands has curtailed this work during the war.

In winter, the ducks keep one completely enthralled. I have been close enough to a black duck for his weather eye to look right into mine as he gained height on his silver-lined wings. The mallards, with their gleaming green heads and white-edged tails, usually rise with the black ducks. We always crept up to the ponds without speaking. The ducks don't notice steps, but the voice or sight of man generally disturbs them at once. Some of them refused to pay any attention at all. Handsome black-and-white pintails frequently posed without flying off. I had always thrilled to the brilliant colors of the wood duck. "Take the binoculars," Bob said. "There's one sitting on that post." On Bull's Island I could look and enjoy as long as I wished.

Sometimes a pond would be full of baldpates, which stayed right where they were, or there might be myriads of ducks of all kinds among the duckweed which shone vivid green in the sun.

A special pride of the refuge is a great flock of oyster-catchers, black and white, with vain red bills. They feed on the flats of the channels or fly along the beaches of Cape Island. Bob described their song to me as "the most exciting and hysterical song in nature, not excluding the loud trill of the pileated woodpecker."

The raccoons, beautiful animals though they are, do so much damage that some have been shifted to other areas. Christmas night we went out to look the 'coon situation over. The three men put on their rubber boots, because we were to be in the swamps.

"You three are protected from snakes, but I am not," I pointed out. "They won't strike you," said Mr. Hills. "They are asleep in winter."

The dog Bruno found the first 'coon and treed it. He was so excited he ran part way up the tree himself, barking furiously. The men played the beams of their flashlights along the branches and in among the Spanish moss. Two gleaming eyes in a round bunch of fur could be seen 40 feet up a loblolly pine, indifferent to the clamor below.

We came out into a clearing and looked up at the three-quarter moon. Orion stalked across the sky, the middle star of his belt over the equator. Venus was gorgeous in the west. The young men wanted to explore further, so Bob and I walked home through the delicacy of the moon-shadowed woods, with their Spanish moss, palm fronds, and here and there water glistening among the trees.

After a Christmas morning celebration of filled stockings and a tree, we three started out on a memorable walk. Cardinals flew in and out of the cedars, and mockers were near-by. A few yards from the house stands a live oak, whose branches enclose a "room" 150 paces around. Spanish moss hangs thickly. Usually this so-called moss is associated in one's mind with live-oaks and deciduous trees, but on Bull's Island moss-covered loblollies gave us a surprise.

"The Road"

Beyond, we stepped over a white fence and were on The Road. There are 25 miles of wood road on the island, but only one Road. It is to us one of the most beautiful and exciting roads in the world. Wagon-wide, grass-grown, mile-long, it runs straight across the island to the ocean beach. The first part of it divides duck-filled ponds and is open to the sky.

We walked quietly, watching the small birds in the edging bushes and palmettos, and presently clouds of ducks flushed from almost under our feet. A tiny ruddy duck looked up at us placidly and plunged again and again. Even when Bob climbed down for close-up photographs, the little duck eyed us with friendly trust, swimming near us for at least ten minutes.

The ponds edging the road are varied in a design of sedge and little islets. A view may be framed by a gap in vegetation with an undulating skyline of forest for a background. Sunshine is usually beating down pleasantly, often warmly enough so that one needs only a light sweater at noontime.

Beyond the chain of ponds, one looks through archways of heavy woods to the light over the ocean at the far end of the Road.

The diversity of the trees makes these woods unusual. The main trees are live-oak, loblolly, and palmettos. There are feathery cedars, a few hollies and the dark glossy foliage of the southern magnolia with scatterings of red gum, maple, elm, and others. The forest vines, the palmetto, the long gray Spanish moss, which takes on a green tinge in sunshine, the clumps of mistletoe,—all lend a pleasing tropical appearance without, however, tropical density. The palmettos grow out of the earth whole, like soldiers from the dragons' teeth. First heads appear, full-grown, then gradually full-size trunks press upward. This makes a charming undergrowth, with palm tops waving their fans at all levels from the ground to the tallest ones.

The carpet of the woods, mottled with sun and shadow, is made of palm fronds and pine needles of warm brown, designed with little running vines such as partridge berry, fallen cones, and bits of branches covered with gray lichen. The moss, touching one's face as one passes, is cool to the skin.

A far-off deer jumping, flashed its white rump. These deer are smaller and darker than those on the mainland. Their tracks and those of many other animals were everywhere on the island. Tiny shore-birds' tracks, turkey tracks as big as a man's hand, tracks of many fox squirrels, and pretty raccoon tracks—all were companionable markers of every trip afoot.

The growth next lower to the trees, and also behind the open beach over the dunes, is largely wax myrtle, closely related to our bayberry. Along the dikes, the red-berried cassina almost alone holds sway, though it also grows throughout the woods. It is as decorative as holly for the Christmas table.

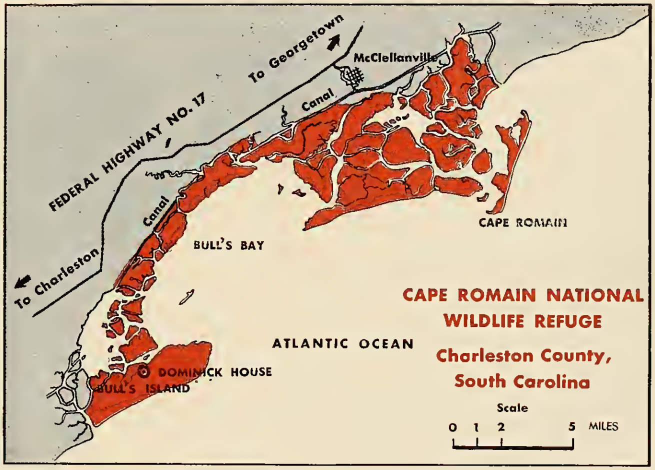
When we left the Road and broke through to the beach without a path, it was hard going. Catbriers and berry-laden vines were festooned everywhere. The burs were terrible, and even worse were the cactus spines, some of which pierced through my heavy leather shoe into my foot. Mr. Baldwin told us he once found an oyster-catcher with a two-inch spine in one of its feet. Quiscala, our unclipped black poodle,—not the kind of dog for Bull's Island,—could pull off some of the cockleburs but had a bad time with the cactus. She learned to sit down and wait for one of us to relieve her. She never lost her exuberance, but we spent quite a share of our time getting snarls out of her coat. Her favorite sport, and a harmless one, was chasing sanderlings on the beach, leaping the wavelets as they rolled in. It didn't hurt the birds and it gave Quis—and us—a lot of fun.

Unexpectedness was our constant delight. One time, migrant monarch butterflies flew over our heads. Again, a fungus on the trunk of a tree was shaped like a clinging imp. In thick woods one day with Amos, a raccoon passed in a split second of high speed, his gray body and color-circled tail sharply clear. I asked about pelicans. "No," someone said, "we will see none at this time of year. They are all in Florida." The next moment, Amos called triumphantly and we were watching one flying low over the water.

Bird census

The Christmas Census, the High Mass of the year for the ornithologists, was taken on December 27. It is approached with a height of fervor under the fun and laughter of a day out-of-doors. To get a big list of birds —bigger than last year's or than the other fellow's,—requires determined work from dawn to dark, with no time out.

▲ THE AUTHOR releases a banded male wood duck, one of the most beautiful of North American birds, after Mrs. Alexander Sprunt, Jr., has recorded its number and other data



▲ ONCE this 21-mile stretch of South Carolina coast was favored shooting country. Now it is as safe a place as a bird can find in which to build its nest

▲ HOME POND, near the road, feeding-ground for many kinds of ducks

While the Charleston Group was combing the mainland, we worked the island all morning. I wore in my hat the lapwing badge of the International Ornithological Congress, held in Denmark in happier days. I started to call Quiscala. Bob looked shocked. Frolicsome pups were not included on a big Christmas Census.

For me, the out-of-doors means beauty of line and color, with the stir of living things. Wherever I looked on the Island, I saw a bird or the motion of a bird. But I hear none of the sounds. My men tell me about the bird calls, some of which I clearly remember, and other sounds, like wind in grasses, come back in thought. My eyes are so busy that I "take the cash and let the credit go." Dr. Frank M. Chapman, who is the dean of all ornithologists, helped me about that, though he does not know it. In Denmark, everyone was listening to a nightingale. Thinking the others had gone in, I tried to get close to the bird, holding up my hearing aid, hoping to catch one note. I couldn't, and turning, looked straight into a world of sympathy in Dr. Chapman's eyes. By the strange law of opposites, that look, in its understanding, has stuck by me ever since. I think of it and not of what is missing.

Alligator!

The men, walking ahead over the dikes which cross and recross the marshes and ponds, stopped at a sea of yellow grasses that were full of light held over from yesterday's sun. It was cloudy and cold. I came along behind them, calling myself their old squaw. They were too busy with birds to see anything else, so passed right by a six-foot alligator asleep in matted watery weeds. I called them and they came back. Amos threw a stick, but the beast did not budge. We flicked water on him with a palm branch. Still he did not move. Finally a long plank tossed at him spoiled his sleepy sun bath; he plunged and swam away underwater, a trail of bubbles marking his direction.

"We would have missed that fun but for Mother," said Amos, which put my stock up, for my usual way of identifying birds is to say: "Bob, there is a little brown bird in the path. What is he?"

"A swamp sparrow, dear."

Yet the tide of devotion to natural history rises through the years to engulf anyone who stops for it. Some knowledge is bound to sink in!

"Don't miss the pileated woodpecker, Bob," I would call, as the beautiful red-tufted bird flew near. There were many of them this year.

All over the Island great flocks of redwings streamed above the grasses in undulating waves or fed on the seeds of the tallest pines, in close and graceful formation. My husband says the observation may be a new one. Their way of flying is a kind of music: close—whir, close—whir.

Bob made a squeaking sound, and a sharp-tailed sparrow flew out of the grass. "That was the one I wanted," he said.

A flicker crossed the path ahead, golden-winged. A thrasher flew here, a hermit thrush there. Brown creepers, red-breasted nuthatches, house wrens, blue herons, snowy egrets, a bald eagle on a post—these were only a few of the birds on the long list we were making. Above us sailed red-shouldered hawks, red-tailed hawks, and turkey vultures, whose wings end in "fingers" of clear silhouette. At noon, the Charleston Group arrived in the launch. Drizzling rain forced us to eat sandwiches indoors, but we were quickly out again to cover the whole island in three groups. By the end of the day our own list totalled 131 species. I wondered whether I would dare come back in spring, when in the dead of winter there is so much to see. Spring must be overwhelming at Bull's Island!

Not even on the island could we get away from war reminders, for there was a bomb target on a far meadow. The student aviators had pitted the surrounding country with practice bombs, and one fire had been started, burning some palmettos. It was extinguished quickly by the Army fire guards, with little damage.

At this end of the island the ocean has within a few years encroached over three miles. The most recent of the undermined trees were twisted skeletons on the beach. Forlorn? Perhaps, but it is an interesting procedure. For the waves that have broken down will again, under other circumstances, build up. It makes one feel the unimportance of one isolated event in the long history of the ages, with their surge and tide, even though that event be the most painful war. What has been done will be softened, and time will continue. The pain will be forgotten in the majesty of the succession of the centuries and in their effect on the forests, the beaches, and even on humankind.

Balanced nature

In an unplanned wilderness of olden times, the balance of nature took care of itself. Predatory animals were kept down by being preyed upon, and their victims were numerous enough to multiply in spite of depredations. But when man's hand is brought into the situation, the balance is often upset. Out of 22 wood duck nests Mr. Hills had found in hollow trees, 18 sets of eggs had been destroyed by chicken snakes or raccoons. Alligators like to eat ducks, which is not a diet the refuge approves of. Which of the animals are living in a relation of balanced adjustment and which are not? A study is under way to find out how much damage deer ticks do to the turkeys. There are five kinds of ticks on the Island. I picked one off me on the beach.

"Bob, is this a dangerous tick?"

"Yes," he answered, "the kind that spreads spotted fever." As they are easy to get rid of, there is no danger. The ill effect of the ticks on the turkeys is more important.

My husband is almost as full of surprises as is his mistress, Dame Nature. He is always bursting into a new branch of his profession about which I had heretofore thought he knew next to nothing. This time it was shells. He filled his pockets with them. Quiscala caught his ardor and came bounding to bring him specimens. He packed them, brought them home to New York, and identified them. His notes bristle with sketches of shells and other beach gatherings, with their Latin names. There are several kinds of whelk and several clams, including the razor. There are skates' eggs, sea urchins, sand dollars, purple-red corallines, and cockle shells. The ocean beaches of the Island hold fully as much variation as the woods. Gannets plunge far out, wings closed. An eagle flies low. Porpoises leap. There are great flocks of various kinds of gulls. There are red-billed terns, with black-tipped white wings. There are white-winged scoters. Small shorebirds, sanderlings and other sandpipers, and plover eat their fill along the incoming waves' edges. The wind makes little sandstorms. And ripple-marks at tide-line are sculptured in the sand.

I have no space to tell of the winter insect life, the fiddler crabs, the ground spiders' webs white with mist, or the several kinds of lizards.

Our whole coast was once as rich in wildlife as the Cape Romain Refuge is today. The work the Government is doing all over the United States reclaims and improves similar areas ideal for its protection. Yet not until the public is really educated to their value, can the tide of destruction be turned to a strong one of construction. As Russia and Mexico can turn an illiterate people into a literate people in so short a time, so our alert Americans can be more thoroughly awakened than they are now to this all-important matter of conservation.

If all sorts of commercial products can be made household words in every corner of the country, certainly an adequate campaign on this far more important subject can reach every American. Then public feeling and public knowledge will curb the minority who care more for selfishness and profit than for the general welfare.

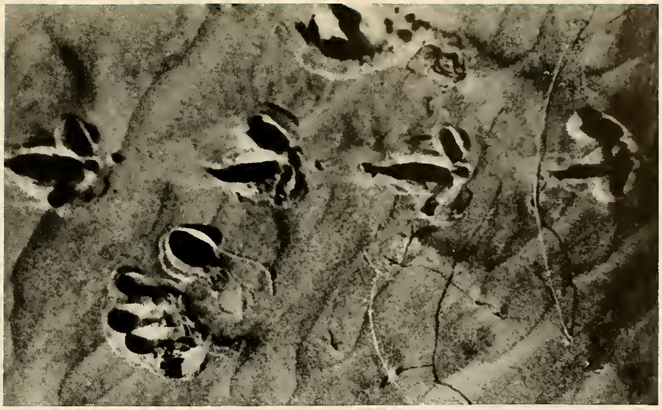
People used to throw out their great-grandmother's china. No one does so now. We put it on display. We are alive to its value. Our wildlife is worth at least equal care. As a people we love the out-of-doors. Our National Parks show this with their attendance statistics. Yet the basic principle of conserving our outdoors is still known only to the intelligent few.

During the year of 1944 in my job of war grandmother, I was in 32 states. Erosion in one place or another, bad logging with all rules broken, bad farming, even on Long Island, wild flowers wiped out, birds scarce for lack of cover and because people do not even know their value in relation to crops, are all common matters.

Here and there, hopeful signs appear, such as a roadside advertisement by a pulp company's experimental station: "In 1943, 178 trees were cut on this acre, 163 trees were left."

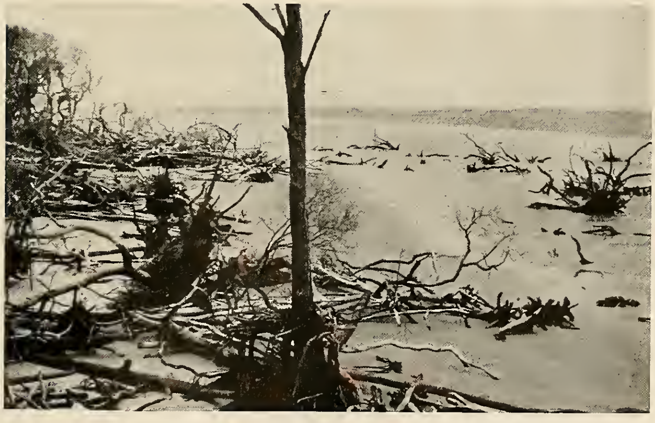
Yet not until all of us know and really care with our whole hearts and minds will destruction stop.

Can't we sell the idea as Victory Bonds are sold? Our men fought united. Can't we unite to conserve the physical value and beauty of what they fought for, with every child and every adult knowing the reason and all the ways of doing the job? The Government and increasing members of people are pointing out the road.



▲ SHOWING HOW WILD TURKEY TRACKS compare in size with the print of a man's hand: a photograph taken among the dunes behind the ocean beach

▲ A RACCOON has passed, leaving its "fingerprints" on the wet sand. The 'coon is the only abundant predatory mammal at Bull's Island, which has neither opossums nor foxes



▲ AT THE NORTH END of the Island the ocean has within a few years encroached over three miles. Trees are twisted skeletons on the beach

▲ 100% CONCENTRATION ON THE OBJECTIVE. The gooney orphans found Shipfitter 2/c Wagner just as good a provider as their lost parents. It takes about three days before these youngsters will accept food from human beings. They have to be hungry, and patience is necessary. Wagner has a natural talent for taming birds

FATHER NATURE

By EDWIN D. NEFF

Official photographs U. S. Navy

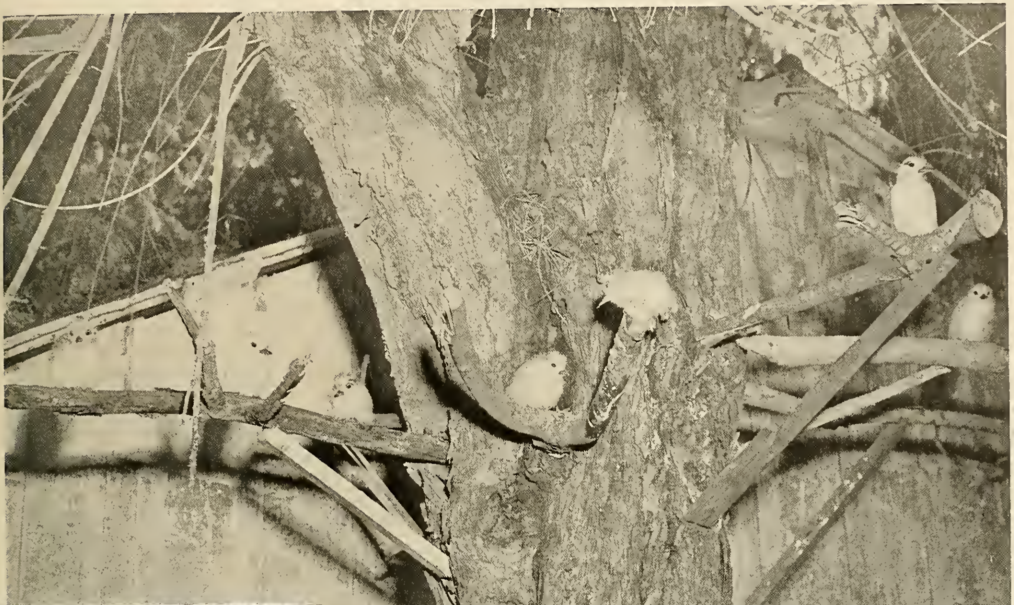
ARTHUR J. WAGNER, Shipfitter second class, may never find his name in boldface on the records of this war, but to the men and officers now on Midway Islands, he has brought many a tug at the heartstrings, and many a smile to leaven the melancholy between mail planes.

Wagner is a diminutive, sparely built sailor of indefinite age whose daily selection of uniform would appall the admirals' tailors. His only consistency of dress is an outsize baseball cap. From under its visor a thatch of blond hair competes with his vision and half obscures a grin as catching as the measles.

To Midwaymen, Wagner is known as "Daddy"; for in addition to his official duties, he has become the founder, proprietor, and principal dietician of the Gooneybird Orphan Asylum and Fairy Tern Annex. The Gooneybird Asylum is located in a patch of grass near the dispensary's maintenance shack, while the Fairy Tern Annex has been grafted to an ironwood tree athwart the shack itself. Both institutions had a spontaneous beginning. From time to time tragedy overtakes the parent gooneys, leaving their young to starve. Next to the gooneys, the fairy terns are the most popular birds on the islands. They are dainty as girls, snow-white with shoebutton eyes. Sometimes the infants fall from their trees, or are kidnaped by overzealous nature students picnicking in the ironwood groves. If a man has had a few cans of beer, it may be difficult to say which tree he plundered, and the only decent course is to turn the youngsters over to Wagner for care and feeding.

When word got around that Wagner was adopting bird orphans, his institutions began to fill. Because he is built rather close to Mother Earth, Wagner had to nail several lengths of wood to the ironwood tree within reasonable distance from the ground. These are now crowded with hungry terns, and from day to day Wagner must add new wings to the annex. Upon these the fluffy, chick-like infants crouch, demanding food interminably.

While all of Wagner's infants are orphans, some are victims of additional misfortune. One of the young gooneys broke a leg, another fell into a tar pit, and a third was so long without food that it could not support its head. This



▲ THE MIDWAY FAIRY TERN ANNEX. This is the house that Wagner built for his tern infants. Each had lost its parents and now depends entirely on human kindness

◄ IT ISN'T MAMA, but a youngster has to eat. Infant terns demand fresh minnows for breakfast, lunch, and supper. This one looks a bit doubtful, but he's going to give in last Wagner named "Wobbly," and it became his favorite. After getting its strength back, Wobbly charged across the street to attack another (well-fed) youngster, who, doubtless, had been smirking at him. The attack was a mistake, for the youngster's parent appeared from behind a scaevola bush and beat Wobbly within an inch of all his feathers. Wagner rescued him.

The "tar baby" was more difficult. He had had the bad judgment to explore the perimeter of a tar pit and, when only his beak was protruding, was hauled out. Wagner sliced five pounds of tar from his feathers with a succession of razor blades. For a day or so the miserable bird associated all his troubles with his benefactor and pecked at him furiously, refusing all food. Finally he was seduced with an unusually fragrant bit of tuna. Now he follows Wagner around like a puppy.

Occasionally Wagner finds himself with an adult to care for. One was brought in with a broken leg, and Wagner rigged up a kind of bosun's chair which supported the bird and permitted its legs to hang beneath. Wagner taped its wings to keep the bird quiet, and reset the leg. He had to make a sling to support the bird's beak, since normally gooneys sleep with their bills tucked under their wings like a canary. Wagner's excursion into orthopedics came to nothing. The ungrateful bird waited until night and somehow escaped.

Wagner now is feeding nearly a dozen young gooneys and eight infant terns, all of whom had been written off the books by Mother Nature.

It is hard to say whether he knew what he was getting into, but he had some warning.

About in the middle of his experiments an adult gooney suddenly appeared and made little visits with each of the youngsters. She spent a night with each, "talking" to them and grooming their feathers. Wagner figured she was passing them the latest word on the bird community, and named her "Scuttlebutt Sally." But Sally may have become appalled at her undertaking, because she soon vanished.

Wagner's life is becoming increasingly complex. He finds himself starting at the slightest sound, and a chirp from his youngsters sends him scampering to the galley doors for scraps of fish. The gooneys will settle for one feeding a day, but the tern youngsters are voracious and will eat only freshly caught minnies. This poses a problem in ethics for Wagner. He so loves all animals that he finds himself debating whether he should take the lives of the minnows in order to feed the terns. He fights this battle with himself every day. So far the terns have always won.

A baby tern is scarcely as large as a baby chick, yet its capacity for minnows is beyond science. Each can account for a dozen or so a day, though you would think two or three would be the limit.

This routine is running Wagner ragged. Close friends swear he is losing weight while his orphans grow fat.

"At least he has his evenings to himself," we offered.

"By no means," a bystander replied. "Look over there in those bushes. That's his moaning bird pet. That one will eat only after dark!"

▼ SOMETHING ON A STICK. Wagner shows off his whole tern family. The little one on the end was afraid of the older boys and sat in splendid isolation

Continued from page 441

one of the foremost authorities, says, " 'The venom of most scorpions, then, is not dangerous to man. The characteristic reaction to this venom is a local, often painful swelling—sometimes accompanied by discoloration at the site of the sting. In some cases the pain may travel a short distance from the original site. Where normal conditions of health prevail, there is absolutely no danger of death, even in tiny infants.' "

[An article giving further information on Arizona scorpions may be expected shortly in NATURAL HISTORY.—ED.]

* * *

CATS AND BABIES

SIRS:

When we brought home our new baby boy, many persons asked me if I dared let our very affectionate cat in the house any more. "He'll snuff the breath out of the baby," several said. Our cat showed no signs of jealousy, though I know cats do become jealous of babies. I can hardly believe the stories about cats deliberately putting their nose to an infant's nostrils to take its breath. Would such an action have any attraction for a cat?

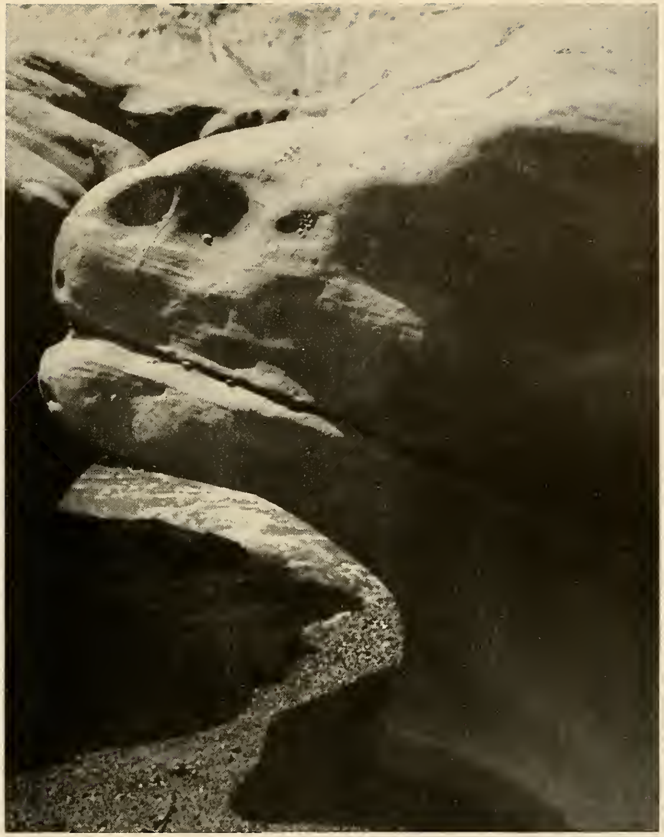
MRS. BILL LANCASTER.

Kent, Washington

I do not know the origin of the story that a cat will suck a baby's breath. It probably originated in ancient times, for cats have always had an occult significance, whether as good or evil spirits. Among primitive peoples the breath was considered the soul, spirit, or life, and the story probably at one time involved the idea of a devil removing the soul of the infant, replacing it perhaps with a demonic soul.

It would be physically impossible for a cat actually to suck the breath from a baby; and what would a cat want with the partly exhausted air from the lungs?

However, there may have been a case or so where a cat caused a baby to suffocate. The warmth of a young child is quite attractive to cats, and I have seen on several occasions a cat crouching down on the chest of a child, purring away with comfort. The weight of a large cat might collapse the thoracic bellows of a baby and smother it in this accidental manner.



▲ A REMARKABLE LIKENESS of a prehistoric monster, photographed by Bernice Band Darley on an Oregon beach

More dangerous are disease germs which cats may scatter about.

JOHN ERIC HILL,
Associate Curator, Department of Mammals.

The American Museum of Natural History, New York, N. Y.

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PHOTOGRAPHIC NOTICE

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be happy to try to have them answered.—ED.

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YOUR NEW BOOKS

Continued from page 443

one of the leading literary naturalists of the present day, writes with a pen which "not only accuracy governs, but imagination inspires." This volume is made up of 30 short essays on a variety of subjects, each one, as indicated by the sub-title, being a real adventure of the naturalist-author. The collection gets its title, *The Lost Woods*, from the first essay, the Lost Woods being the one on his grandfather's farm in the dune country of northwestern Indiana, which he knew as a small boy and which disappeared in the subsequent 30 years,—a world that was, but now is just a memory.

"Boundaries of the Night" (Chapter 15), an imaginary spanning of the continent, from Maine to California, with the advancing night, is a particularly fine piece of writing.

Although the book is remarkably free from error, the author's naturalist friends will probably question his reference to the king crab as "the oldest existing form of life." How about the lingulids? The statement that the song sparrow is "the commonest and most widespread of North American birds" is open to question, for the breeding range of the robin is greater in extent than that of the song sparrow. Most naturalists will doubt the pilot's observation that a duck hawk passed him at a speed estimated to be twice that of his plane, when he was flying at 175 miles an hour. And where the author speaks of the spectacular "love dances," of the great blue heron, we wonder whether he has not confused the bird with the sandhill crane.

But these are trivial matters in a book which this reviewer found to be altogether fascinating. Two hundred of Mr. Teale's superb photographs add greatly to its attractiveness.

CLYDE FISHER.

MODERN BIRD STUDY

- - - - - - - - by Ludlow Griscom

Harvard University Press, Cambridge, Massachusetts, $2.50
15 photographic illustrations, four maps and diagrams, 190 pages

DR. GRISCOM'S book *Modern Bird Study* is an outgrowth of a series of eight lectures delivered at the Lowell Institute, Boston in 1944. These lectures have been thoroughly revised and extended to ten chapters.

In the first chapter the work of the exploring or cabinet naturalist is contrasted with the varied interests of the student of modern bird study. The cabinet naturalist deals primarily with dead birds in the form of skins, while the latter deals with problems involving the living bird in its natural environment. Dr. Griscom is admirably well qualified by experience to present and evaluate both of these points of view. In the four chapters that follow he discusses the many interesting problems of the capacity and intelligence of birds, their adaptability and migration. Every important theory or statement is illustrated with lucid examples. The beginner as well as the professional ornithologist will gain much by reading these chapters.

In chapters six to nine inclusive the complicated and difficult subject of distribution is presented with a clearness that even the amateur can easily understand. He deals specifically with distribution in South, Central, and North America, regions which he personally has visited many times. The comparisons and contrasts of these three regions are well presented and most interesting. Needless technical details, though important, are purposely omitted in order to give a concise and clear picture of the subject.

The last chapter deals with the perplexing problems of classification and the species concept, and as in other parts of the book many illustrations are presented to put over to the reader this important aspect of ornithology.

The book contains a wealth of information, and best of all it is destined to stimulate the intense interest of the beginner. Furthermore, it shows to the amateur how his observations will contribute in solving the various problems of modern bird study—a study far from completed, for we are only on the threshold of the great storehouse.

There are a few errors, for example the facial markings of the Eastern and Western Flickers on page 30 and again on page 177 are confused, but such errors do not in the least detract from the great value of the book. Every student of birds should have a copy of *Modern Bird Study* in his library.

ALFRED O. GROSS.

THE LIFE OF AN AMERICAN NATURALIST

- - - - - - - by Francis B. Sumner

The Jaques Cattell Press, $3.00
298 pages

THE author of this autobiography was a zoologist of world-wide fame. His graduate work was done at Columbia under Edmund B. Wilson, Bashford Dean, and Henry Fairfield Osborn. After taking his Ph.D., he taught a few years at C. C. N. Y. For eight years he was director of the biological laboratory of the U. S. Bureau of Fisheries, at Woods Hole. Since 1913, until his recent retirement, he had been Professor of Zoology at Scripps Institute, La Jolla, California. For three years he was a research associate of the Carnegie Institution, Washington, D. C. In 1899 he was a member of the Columbia University Zoological Expedition to the Egyptian Sudan.

This reviewer was attracted to this volume by a very realistic and candid article in *The Scientific Monthly* of August, 1945, entitled "A Biologist Reflects Upon Old Age and Death." On September 6 of this year, Dr. Sumner died at La Jolla at the age of 71 years.

The narrative begins with his earliest recollections, which he calls "The Farthest Limit of Retrospection." A discussion of his immediate ancestry he calls "The Shuffle of the Genes." We have a brief chapter on his social adjustments and maladjustments. He describes his undergraduate

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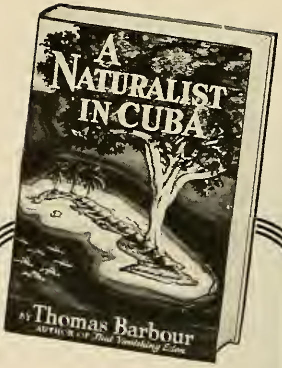

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Continued from page 478

days at the University of Minnesota, and his graduate work at Columbia. A carefully written vivid story of the expedition to Africa for fishes, under the direction of Dr. Wilson, is taken from his diary. Summers at the marine laboratories at Cold Spring Harbor, where he was once a student; at Woods Hole where he was director for a number of years; and at the Stazione Zoologica at Naples, where he did research work, furnish interesting chapters. Besides his life work on fishes, he carried on important research for 17 years on heredity and the influence of environment in mice.

Dr. Sumner has given us a carefully written story, for he possessed unusual literary ability. One is bound to admire his evident and convincing honesty and frankness. He must have been a serious-minded person, for through it all there seems to run an under-current of realism bordering on pessimism.

CLYDE FISHER.

MIDWAY PHOTOS AND VERSE—OR WORSE

- - - - - - - by Lewis Walker and Loring Hudson

Hester Colorgraphic Studios
San Diego, California, $2.50
86 pages, 82 photographs and cartoons

THIS book combines the sublime and the ridiculous. The large and beautiful reproductions of photographs depicting two species of albatrosses, several of terns, tropic birds, man-o'-war birds, petrels, shore birds, rails, mynahs, and cardinals, together with incidental portraits of geckos, mongooses, and the rare Hawaiian monk seal, are superb examples of the natural history photographer's craft. The cartoons and the verse (or worse) on facing pages are rough stuff. The least (and the best) to be said is that the drawings and text are not without point, and in some instances might even create interest and sympathy for the gorgeous subjects of the photographs. If the lonely, long-suffering and sometimes bored men in naval and military service on the Pacific islands like their phenomena served with such sauce, who are we to criticize? Any naturalist would be lucky to possess this book for its photographs, and perhaps a thousand times as many human beings will buy it mainly for its drawings and text!

Particularly notable among the photographs are several showing the juvenile appearance and behavior of the fairy tern, which never knows a nest as either egg or chick. Other superb shots include the wing-and-bill salute of the Laysan albatrosses and a particularly exquisite photograph showing the overlapping nesting grounds of this species and its neighbor, the black-footed albatross. Among so much that is lovely, however, it is difficult to pick out favorites, and this book must be destined to be equally at home in ornithological libraries, barracks, and barrooms.

R. C. M.

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(Cooperating in Social and Civic Action)
Ashkee of Sunshine Water (Navaho Indians)
Buffalo Caller (Plains Indians)
Down the Santa Fe Trail
Fire Fighters (Fire Protection, Past and Present)
New Amsterdam Colonial Days
New England Colonial Days
On the Oregon Trail
Prairie Children (Pioneer Home Life)
Southern Colonial Days
Story of Democracy

MAJOR AREA II—

(Earning A Living)
Daily Bread and Other Foods
From Barter to Money
The Story of Trade

MAJOR AREA III—

(Adjusting to and Improving Physical Environment)
America's Minerals
America's Oil
The Motor Car in American Life
Our American Forests
Our Inland Seas, The Great Lakes
Soil, Water, and Man
Buried Sunlight (Story of Coal)
Man's Use of Plants and Animals
On the Airways (Aviation Today)
Wonderful Wings (Story of Aviation)

MAJOR AREA IV—

(Personal Development and Guidance)
The Fight Against Germs

junior high school

PHYSICAL SCIENCE

Ask the Weatherman
Beyond the Solar System
The Earth's Changing Surface
The Earth's Nearest Neighbor
Fire, Friend and Foe
Heat
Light
Our Ocean of Air
The Sun and Its Family
The Ways of the Weather

BIOLOGICAL SCIENCE

Balance in Nature
Insect Friends and Enemies
Insect Societies
Life Through the Ages
Soil

The BOOK SHOP

77th STREET AND CENTRAL PARK WEST, NEW YORK 24, N. Y.

LETTERS

Sirs:

Would it be possible for you to please send the enclosed sum of $25.00 to Arthur Wagner, Shipfitter on Midway, whom you mentioned in your article "Father Neptune" in the December issue? I am sure he will accept it through you as a Christmas present or as support for his bird asylum.

I have often gone through the same worry bringing up orphan birds. That's why I wanted to send Mr. Wagner a greeting and wish him good luck. . . .

(Name withheld by request)

On behalf of Shipfitter Arthur J. Wagner who, not knowing the donor's name cannot thank her, and who even in military service was only following a more basic human inclination, Natural History Magazine expresses warm appreciation for a gift that was generated by the sort of impulse which some people think is more powerful, in the long story of human hope, than the atomic bomb.—Ed.

* * *

Sirs:

. . . It seems to be the general opinion that the undue amount of rain or bad weather we have had could be blamed on atmospheric conditions caused by bombings and other explosions of the war. I had believed it mere advertising when local fairs or circuses "sent up something" to guarantee fair weather. Is it possible for man to affect his climate?

Kent, Wash. Mrs. Bill Lancaster.

The following answer is offered by F. W. Reichelderfer, Chief of the U. S. Weather Bureau:

A special study of this question made at the time of the first World War led to the conclusion that no effect on weather had been produced by the war. It has often been suggested in the past that great battles cause rain, but a critical examination of records shows that this impression is unjustified, and those occasions on which rain has fallen after a series of explosions have been found to be mere coincidences. The experiment of attempting to induce rainfall by explosion has actually been tried on a number of occasions, but it has not succeeded.

These results are all in accordance with what we should expect from our knowledge of the physical processes by which rain is produced. Weather conditions are the result of the interactions of the great streams of air from different regions that are continually flowing over the earth. They would have taken place in the same way even though no wars or other special conditions brought about by the activity of man had occurred. Irregular fluctuations in prevailing weather conditions are continually experienced in all localities; and it must be kept in mind that at any particular time the weather is quite likely to be unusual somewhere.

It is exceedingly difficult to realize the tremendous scale on which atmospheric phenomena take place. The physical processes by which weather is produced are on so gigantic a scale and involve forces and energy of such inconceivably great magnitudes as, in general, to make it impossible for them to be appreciably modified or influenced by any of the activities of man.

* * *

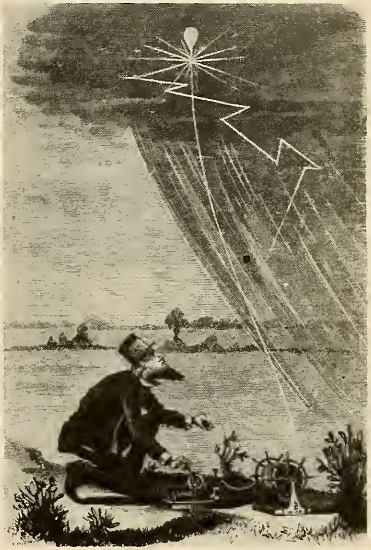
Sirs:

Concerning the feeding habits of toads, the letter you published from Mr. Charles S. Putnam and the comments of Curator Charles M. Bogert, recall some pertinent, though rather casual, observations of my own.

In 1927 I was living for a time at a hydro-electric power station on the Paraguassú river in the State of Bahia, Brazil. The terrace, which was our sitting room in the evening, was not screened, and every conceivable variety of flying insect swarmed about the lights when they were turned on, particularly a large black beetle, called by the Brazilians "bisouro," which seemed nearly hemispherical and was about five-eighths inch in diameter.

The cloud of insects promptly attracted the toads, which climbed the five or six steps from the ground to the terrace level,

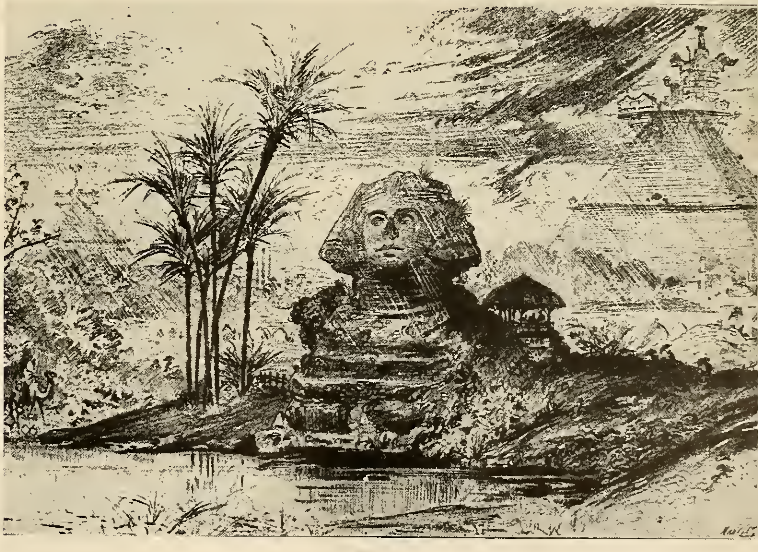
Continued on page 46



➤ An early attempt to control the weather (1880). The device consisted of a balloon that would lift explosives into the sky, where they could be set off electrically through the mooring wire. Meteorologists today doubt the practicality of any such methods

⮟ A fantastic scheme to turn the Sahara into a fertile garden was depicted in 1882. It depended upon a large "rain generating machine" atop the pyramid of Cheops

The Bettmann Archive



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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President — ALBERT E. PARR, Director

VOLUME LV—No. 1 ★ ★ ★ ★ JANUARY, 1946

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From a Kodachrome by Saul B. Arenson. See page 7

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"TORNILLO" or *Screw Bean*

By JEWELL CASEY

MOTHER NATURE might be accused of "laughing up her sleeve" when she produced the Screw Bean, for it is indeed a "joke plant."

So called because of its curious, slender, spirally-twisted pods, the screw bean belongs to the same family as the mesquite, the Mimosa family. It is scientifically called *Prosopis pubescens*. Other names by which it is known are Curly Mesquite and Tornillo.

The screw bean grows in suitable localities from western Texas to southern Utah, and westward to California. Like many other native desert plants it is armed with long, sharp thorns, capable of inflicting painful wounds.

In early spring the plant presents a very pretty appearance, being clothed in tender green foliage and numerous clusters of very fragrant, greenish-yellow flowers. At maturity it is a shrub or small tree of 10 to 20 or even 30 feet high. The wood, while not as hard as mesquite, makes good fuel, and the branches are useful in building fences and huts.

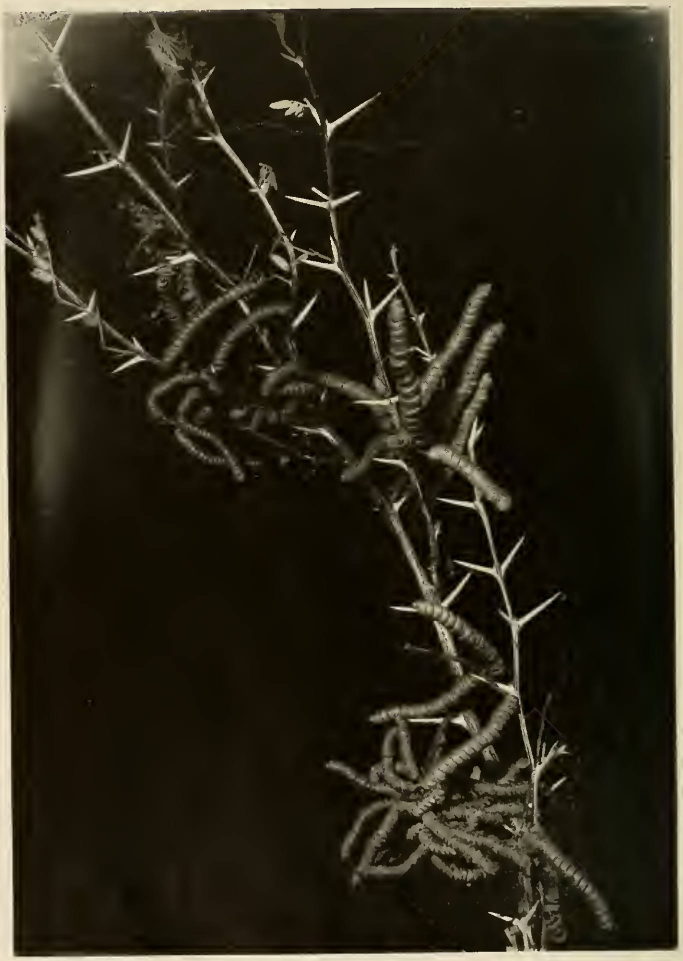
The curious bean, or pod, makes from a dozen to twenty turns as it matures, forming—when ripe—a narrow straight spiral, one to two inches in length. However, it can be drawn out in the manner of a coiled spring, and it then often measures more than a foot in length.

Like the mesquite bean, the screw bean is rich in sugar content, and when boiled in water it yields a fair grade of molasses. The Indians and Mexicans use the beans for food purposes, grinding the entire pod,—seeds, husk and all,—into a sort of flour. This is used in making bread, or the flour may be soaked in water and used for making a very pleasing and nutritious drink. The Indians of the Southwest have long used the bark, particularly that of the roots, as a poultice for the treatment of wounds. The sweet pods are relished by many animals, both wild and domestic.

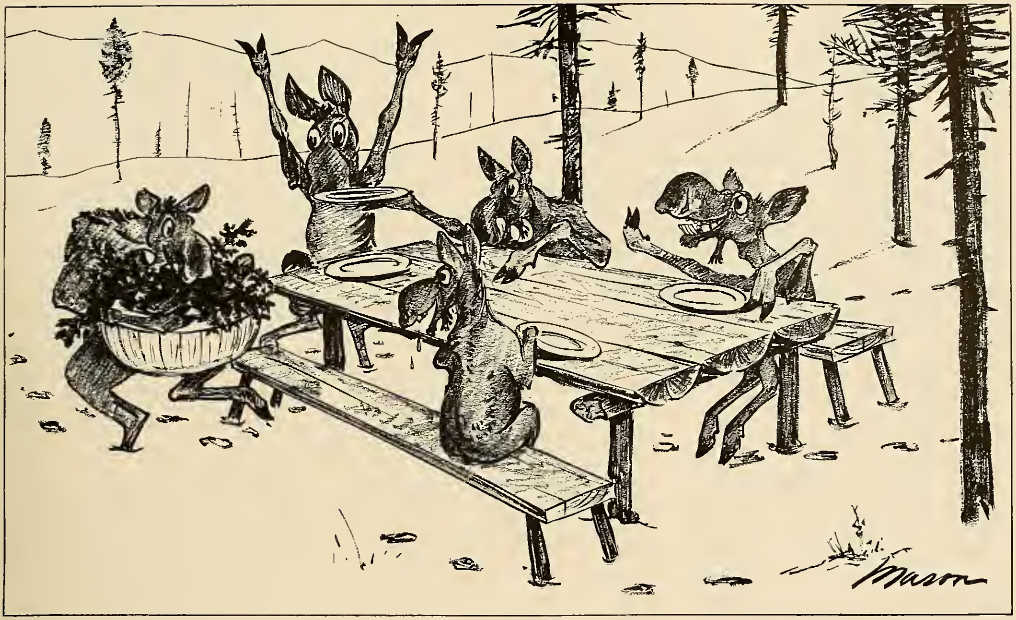
This desert plant has the ability to send its roots to great depths to reach the water level, as does the mesquite, which is reported to penetrate the ground to a depth of 60 feet. The roots are usually far greater than the top and are put to some of the same uses as the wood itself.

Prosopis cinerescens, another species of the screw bean, is a low-growing, shrubby plant, which has the peculiar habit of blooming and bearing fruit when only a few inches high.

THE SPIRAL of each "bean" can be pulled out like a coiled spring to a length of a foot or more



WINTER SCARCITY



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

IN Europe and parts of Asia this winter, many millions of people will be hungry and thousands will die of starvation.

Winter in the northern woods often brings these times of starvation even to the animals best suited to survive there. During several favorable years the moose may increase, populations may be built up higher than can be sustained by the available food supply. If, on top of this, a severe winter should come, with snow six to eight feet deep, many moose starve to death.

The moose, largest and most ungainly member of the deer family, is adapted to life in the northern woods, with its long, powerful legs and high forequarters. It is found from Nova Scotia and New England to Alaska and, in the Old World (where it is known as the elk) across Siberia to Norway and northern Germany, living in the spruce-fir and mixed forests.

During the summer there is usually abundant food for moose, which are chiefly browsing animals, feeding on the leaves and twigs of many hardwood trees. A moose will seize a branch near the base and run its mouth along it, stripping off the leaves. Branches too high for this may be torn down by the great pendulous upper lip and stripped. Grass is also eaten. When it is short, the moose may kneel or straddle with its front legs like a giraffe, but the legs are so long and the neck is relatively so short that grazing is an effort. Moose often wade out into ponds and lakes to dive for water-lily stems and roots and other pond weeds. In marshy places and around lakes, the animal feeds on sedges, rushes, and many herbaceous plants. Here the moose sinks deeply into the mud and thus can easily reach even low plants.

But during the present season, most of this food is no longer available. The leaves have fallen, ice covers the ponds and lakes, and the snow buries the frost-killed plants. Now the needles and twigs of the balsam fir form an important part of the moose's diet, together with the bare twigs and bark of birch, willow, aspen, and maple. The coarse, siliceous horsetail, pea vine, and wild grapevine are also relished. With the coming of cold weather moose find a sheltered place where these foods are most abundant and settle down there. Usually a bull, one or several cows, and their young of two seasons form the wintering band. Several young bulls may team up for the season, but an old bull may live in solitude.

As the snow deepens they wander around feeding, forming intersecting and well-packed trails throughout the 100 acres or so of their forage ground, which is known as a mooseyard. The good footing on the packed trails gives moose an advantage against wolves, which otherwise might find them easy victims, helpless in the deep snow.

In very severe winters the food in a mooseyard may be used up, while the snow is too deep to travel far from it. The larger moose are able, by making special effort, to reach higher branches and bark, but the smaller, younger animals unable to secure any of this may starve.

Something like this, but caused by overpopulation rather than winter, happened on Isle Royale, in northern Michigan. This was an ideal place for moose, covered as it was with trees and plants on which they fed, and lacking enemies. Eighteen years after the first small band of moose reached the island they had increased to several thousand, and they had eaten almost all the food within reach. Then in the winter hundreds of moose starved to death or were so weakened by hunger they succumbed to disease and cold. If the government had not intervened to save them, the whole herd of moose on that island might have died off, having destroyed their food supply.

YOUR NEW BOOKS

DINOSAURS ● ATOMIC BOMB ● VOLCANOES
PACIFIC INSECTS ● PHEASANTS

THE DINOSAUR BOOK

- - - - - - - by Edwin H. Colbert

The American Museum of Natural History, $2.50
156 pages, 66 illustrations and charts

COLBERT'S book is a fine piece of work. It tells in clear, connected fashion the story of the dinosaurs and their relatives—tells it simply but without loss of scientific accuracy, with a wealth of good illustrations and useful diagrams. As a conscientious reviewer, I have attempted to find something to criticize as well as praise, but about the only fault I find is that the title, *The Dinosaur Book*, is too narrow. The dinosaurs receive proper attention, but the scope of the treatment is much wider, embracing the whole story of the fossil reptiles and their kin.

Early chapters set the stage by telling of the history of scientific work on these fossil forms, the way that dinosaurs and other reptiles are collected and prepared, and the geologic background of the Age of Reptiles. The evolutionary story begins with an account of the first land animals —the amphibians—, followed by chapters on the ancestral reptiles which sprang from them, the early diverging line that led toward the mammals, and the reptilian predecessors of the dinosaurs. Three chapters which form the core of the book parade these great reptiles before us; later sections give an account of other reptilian groups and the fossil ancestors of the birds. For reference there is a brief synoptic classification and, in the index, a useful guide to the pronunciation of the scientific names used.

The illustrations—about 40 pages of them—are excellent. They include a number of good photographs and reproductions of some of Charles R. Knight's fine restorations. Most, however, are the able work of John C. Germann. These include a dozen new restorations of fossil reptiles, obviously executed with scrupulous scientific accuracy as well as artistic skill.

I wish that I had had this book at hand when, as a youth, I wandered among the fossil exhibits at the American Museum, admiring the lengthy *Brontosaurus* skeleton, towering *Tyrannosaurus*, and the rest of the array of curious reptiles large and small. I wanted to know something of the story of these strange creatures, but there wasn't much in the way of printed matter to help me out. A book like Colbert's was what I needed—and didn't have. Today the inquiring layman or youthful student plays in better luck.

ALFRED S. ROMER.

INSECTS OF THE PACIFIC WORLD

- - - - - - - - - by C. H. Curran

The Macmillan Co., $3.75
317 pages, 97 drawings

THIS is the eighth volume of the Pacific World Series issued under the auspices of The American Committee for International Wild Life Protection, and as in the production of each of the previous volumes, the work was done by a competent scientist. Dr. Charles Howard Curran, Associate Curator, Department of Insects and Spiders, American Museum of Natural History, certainly wasn't handed the easiest task in this series when the insects of the Pacific area were thrust upon him. It's true that insects are important but they are also practically innumerable. Dr. Curran didn't attempt to catalogue and describe all the genera and species of insects in the Pacific World for two good reasons, to wit: (a) He doesn't know all the genera and species and neither does anybody else in the wide world; (b) if he did know them and list them for publication on the thinnest of paper, the resultant volume could be lifted only by a derrick. It is rumored that there are about six million species of insects in the world (about one-tenth classified to date) and our returning service men from the Pacific area probably are willing to bet that most of them—particularly the nasty ones— were on every island they visited.

Faced with the problem of presenting an insect survey of a field so wide and so rich in Diptera, Lepidoptera, Orthoptera, Coleoptera, etc., Dr. Curran simplified it by going no further, in his general plan, than scientific descriptions in as plain language as possible of the various families of insects to be found in the Pacific area. The author often describes certain common or important genera or species, as in the case of disease-bearing mosquitoes and flies, but the best he could do on the whole was to keep insect life of the Pacific World a family matter in this volume. Any reader who is at all interested in natural history will find Dr. Curran's book not only definitely readable but genuinely entertaining. The author, in his scientific enthusiasm for his subject, is not one to hide the light of even a glowworm under a bushel. And insects lead fantastic lives, anyway. Dr. Curran has done them—and himself—full justice in this book. It is indexed and there are 97 drawings to illustrate the text. It's a fine insect book for laymen, and I know it is for laymen or I never would have dared to open it.

JOHN KIERAN.

PUEBLO CRAFTS

- - - - - - - - by Ruth Underhill

United States Indian Service, 50¢
147 pages, 102 illustrations

AN authoritative and informative booklet on the basketry, weaving, pottery, music, painting, and other arts and crafts of the Pueblo Indian tribes of New Mexico and Arizona.

THE RING-NECKED PHEASANT AND ITS MANAGEMENT IN NORTH AMERICA

- - - - - Edited by W. L. McAtee

The American Wildlife Institute, $3.50
320 pages, 12 figures

FOR over 250 years, Old World pheasants have been introduced into the United States. The early attempts to establish them were unsuccessful, but later ones were more fortunate and the subsequent years have found a great spread of these birds across the northern states and southern Canada with little interruption from coast to coast. Protected at first, they are now listed as game birds in many states, and their propagation for shooting purposes as well as more recently for sale as meat, has become an extensive business. More than 2000 breeders are said to be licensed in North America at the present time.

These birds have never become truly domesticated like the barnyard fowl but always retain their wildness. Consequently their rearing presents problems different from those of the poultry yard, while their management in the field is subject to varying conditions in different parts of the country. The present volume, prepared by some seventeen different authors and the editor, discusses the management of the pheasant from a geographical point of view. The situations in eight different regions are treated in detail by the various authors, who have had considerable practical experience in the different parts of the country. These accounts contain a wide variety of information on the life history, behavior, food, ecological preferences, enemies, hunting practices and regulations, and similar topics as well as recommendations for successful rearing of the birds and their encouragement in the wild. There is also a special chapter on propagation, one on the classification and distribution of the members of the genus *Phasianus*, and a historical introduction; and the volume is indexed and provided with a working bibliography.

1

2

THE COVER THIS MONTH

The color photograph on this issue of NATURAL HISTORY shows an Indian on Lake Patzcuaro, Mexico, using one of the large "dragonfly" nets of the region. This picturesque lake is almost 200 miles due west of Mexico City in the State of Michoacan. These views and the Kodachrome on the cover were taken by Dr. Saul B. Arenson, of the University of Cincinnati. "The 'dragonfly' nets," he writes, "are oval in shape and are outlined by a bamboo pole. Straight poles are used to raise and lower the nets. When the schools of small white fish 'run,' they are 'stampeded' into the nets and hoisted to the boat. I have also been informed that the nets are used at night, with a flashlight in the water to attract the fish. The Indians living on the many islands in the lake are Tarascans."

3

5

Those persons interested in the Ring-necked Pheasant from any aspect will profit by reading the accounts in this symposium, while anyone thinking of taking up pheasant rearing as a business, sideline, or mere hobby will find here a mine of valuable information on the subject.

J. T. ZIMMER.

ATOMIC ENERGY FOR MILITARY PURPOSES

- - - - by Henry DeWolf Smyth

Princeton University Press, Paper, $1.25,
Cloth, $2.00
264 pages

THIS is the official report on the development of the atomic bomb under the auspices of the United States Government, 1940-1945. The author is Chairman, Department of Physics in Princeton University, and Consultant, Manhattan District, U. S. Engineers. The report was written at the request of Major General L. R. Groves, who was in complete charge of all Army activities relating to the Atomic Bomb Project. In the Foreword, General Groves says, "All pertinent scientific information which can be released to the public at this time without violating the needs of national security is contained in this volume."

And there is much information here, beginning with a brief survey of nuclear physics and proceeding with a carefully written history of the development of the atomic bomb. The book contains lucid explanations of all the scientific theories and problems involved, as well as a full account of the organization of governmental, industrial, and scientific agencies and personnel in this, the most gigantic scientific project ever undertaken in the history of the world. After reading this book, one is overwhelmed with the realization that the project was successfully accomplished.

Although this volume has been referred to as the technical report, the author rightly claims that it is not "a technical treatise for experts." Anyone who has had elementary training in physics and chemistry can follow the story, for it is admirably clear. A large public will be grateful for Professor Smyth's book, which goes farther into the scientific aspects than the authorized popular report, entitled THE STORY OF THE ATOMIC BOMB, by William L. Laurence. It is needless to say that both of these will be widely read and with much profit.

The last few pages of Professor Smyth's book are devoted to eye-witness accounts by General Groves and others of the New Mexico test,—an enthralling story.

CLYDE FISHER.

Continued on page 43

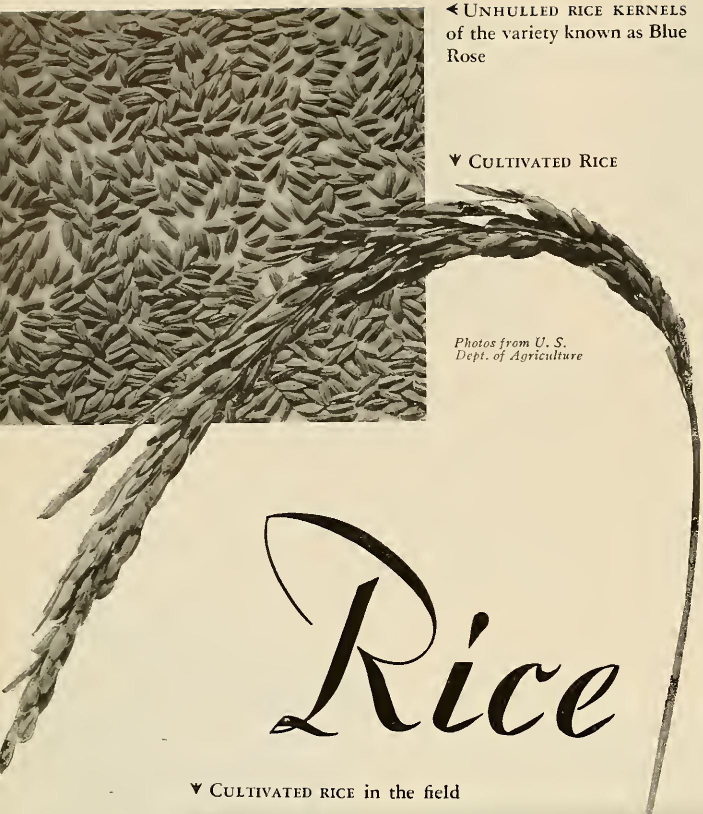
Rice AS A WO

By CLARK WISSLER

Curator Emeritus of Anthropology, The American Museum of Natural History

RECENTLY two articles appeared in this Magazine stressing the importance of wheat and corn in the development of civilization. We now look at rice, the chief crop in the third great cereal area of the world. When the New World was discovered, corn characterized one such area as shown on the accompanying map. In the Old World we find two fairly distinct areas, a central area dominated by wheat, and a southeastern area devoted to rice. Wheat seems to have been first domesticated in Asia Minor, a dry upland country, whereas rice originated in a tropical, rainy, marshy country. The cultivation of each spread abroad rapidly about as far as its growing habits permitted.

The area devoted to the cultivation of rice is evidence of its importance to man. The number of people who de-



◄ UNHULLED RICE KERNELS of the variety known as Blue Rose

▼ CULTIVATED RICE

Photos from U. S. Dept. of Agriculture

▼ CULTIVATED RICE in the field

Photo from U. S. Dept. of Agricul

LD FOOD

One half of the people of the world consider rice their chief food. To examine its role in human life is to travel far back along the corridors of history

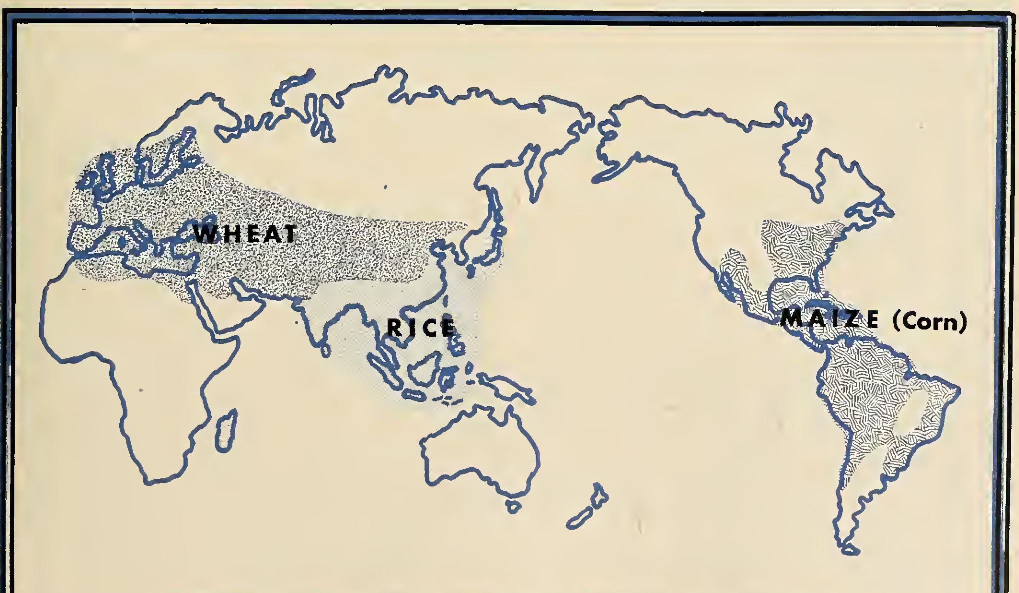
pend upon it for food is even more impressive. Almost everywhere in Southeast Asia, rice ranks as the main food. Because of the density of population in that part of the world, it is estimated that one half of the human race lives upon rice. The other half of the world's people occupy a much greater area, but for the most part they are bread eaters (wheat, barley, rye, and corn).

When we think of rice, we think of China, but in India rice plays an even larger role. British India alone, with a population of about 300 million, produces annually about 600 million bushels of rice. We have no good statistics for China with its 400 million people, but it is estimated that she produces less rice than India. Hence, it would be a mistake to rate China as a whole as being fully dependent upon rice, though rice is the chief food in the southern provinces.

In a region like the Philippines, native life is largely organized around the production of rice. Its importance is shown by the special rituals that accompany almost every phase of its cultivation and processing. It is the only food recognized by such ceremonies in the Philippines. As A. L. Kroeber expresses it in his well-known book,* "The native point of view is clearly that if the success of the rice is assured by the necessary magical and ceremonial means, other crops will automatically take care of themselves. When plant food is offered to the spirits in any connection, it is almost invariably rice. In short, the Filipino not only eats rice, but thinks in terms of rice, and if his civilization is to be described in a single phrase it can only be termed a rice culture."

We have noted that there is still some difficulty in identifying the wild ancestors of wheat and corn, but cultivated rice seems definitely to have come from a single species, *Oryza sativa,* native to the East Indies. All rices grown are regarded as varieties of this species, and they are surprisingly numerous. According to some writers, about a thousand varieties of cultivated rice are known in India alone, all of which are special strains, adapted to local differences in soil, temperature, and rainfall. In the main, however, a tropical or at least a subtropical climate is required. The plants are annuals and reach a height of two to five feet, with panicles (seed heads) roughly resembling oats.

The original wild species required low ground that was flooded at least part of the year. The cultivated varieties known as "hill," "upland," or "dryland" rice can be nursed through the growing season without flooding, but the yield is less and the grains smaller than in the aquatic varieties.



The Three Great Cereal Areas of the World in 1500 A. D.

The Peoples of the Philippines, page 86. (Handbook 8, The American Museum of Natural History.)

Photo by Lionel Green, from Frederic Lewis

▲ CULTIVATION OF RICE apparently came later in history than wheat. But wild rice was probably eaten in the East Indies long before the plant was domesticated. The only implements the first rice-growers used seem to have been digging sticks and wooden spades. Only after the cultivation of rice spread to the Asiatic mainland and contact was made with people who grew wheat and millet were the plow and draft animals adopted. "Dryland" rice, as distinct from that grown in flooded fields, was probably developed through watching wheat farmers at work

▼ WHEN the field is dry and the rice mature, knives or sickles are used to harvest it. A scene in Bali

Photo by Lionel Green, from Frederic Lewis

Methods of rice farming

One of the regions often chosen to best exemplify aquatic rice-growing is the Malabar coast of southwest India. This coast receives torrential rains in May, June, and July, followed by a period of moderately heavy rains in October. The dry season is from December to March. The

AFTER PLOWING, the wet rice field is smoothed means of a "scraper": a scene in Bali

A.M.N.H. photo

▲ TRANSPLANTING RICE. Sometimes the seed is sown broadcast, sometimes it is trampled into the mud. Here the young plants are being replanted, near Baguio in the Philippine Islands

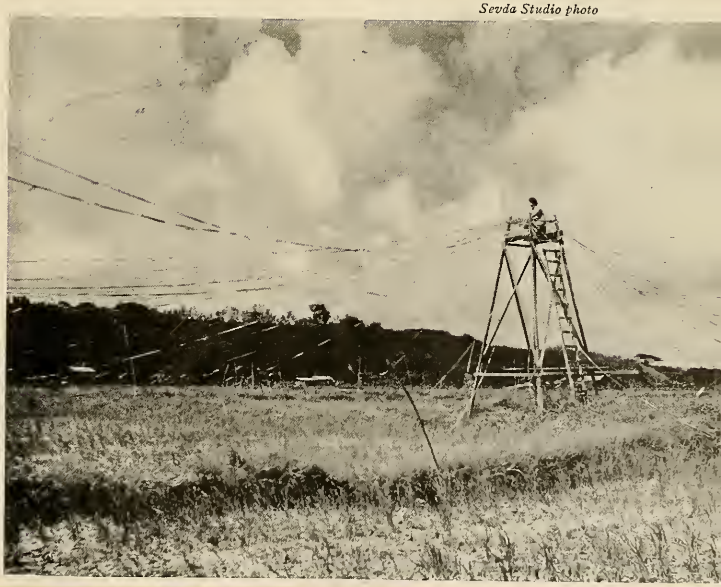
lowlands of the coastal belt vary from 30 to 50 miles wide and are thickly populated by rice-growers. There are 1000 to 2000 inhabitants to the square mile. Originally these lowlands were covered with dense deciduous forests, which were later cleared for rice growing. All the land that can be flooded by impounding rainfall and river water is devoted to rice. Sixty to 120 days are required for a crop, depending upon local conditions. Harvest time is usually in September.

Before the rains begin, a simple pointed plow is used to scratch up the surface of the ground. Water buffaloes are preferred to oxen and are yoked to the plow either singly or in pairs. Cattle dung is spread over the plowed surface, which after the first rains is plowed once more, and the earth is finally smoothed by dragging a log back and forth.

When all is ready, the banks, or dikes, surrounding the field (paddy) are repaired. If the timing has been correct, the rains now begin, and as soon as the ground softens up, the rice seed is sown broadcast, sometimes trampled into the mud, sometimes not. The plants begin to grow in the water-covered soil. At intervals during the growing season, men and women wade into the rice paddy to pull out the intruding weeds. Finally, the water is drained from the paddy

▼ MULTIPLE SCARECROW: an arrangement of lines extending to all portions of the field and jerked as needed from a central tower. This device is used frequently in Hawaii. Constant vigilance is necessary to save the rice crop from birds

Sevda Studio photo



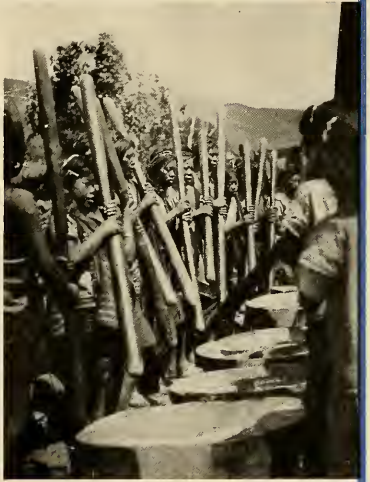
Three Lions photo

▲ A JAPANESE RICE GARDEN

◄ TREADING RICE IN THE PHILIPPINES: the aboriginal method of threshing the world's staple food grains
(Fenno Jacobs photo, from Three Lions)

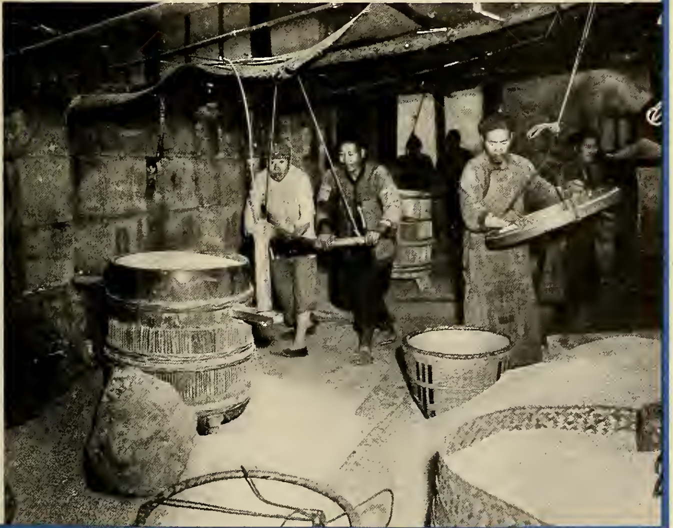
➤ HEAVY WOODEN PESTLES are sometimes used in hulling rice in the Philippines

Theodore Roosevelt, Jr. Collection, A.M.N.H.



▼ THIS VIEW in a Chinese shop in the town of Pishan shows a method of hulling rice that has been in use for centuries

Alexanderson (C N S), from Guillumette, Inc.



to permit the ground to harden. When the rice is mature, the heads are cut from the stalks with various kinds of knives or sickles. Immediately thereafter, millet, pulse, or sesame is sown. Water buffaloes, a few cattle, and sheep and goats are herded upon the wastelands and are fed in part upon rice straw, chaff, and other crop foods, such as millet, oil cake, etc.

Turning from the Malabar coast-dwellers to Asiatic and insular rice-growers in general, we find that wherever the growing period is short, rice may be sprouted and grown for a time in flooded beds and then transplanted by hand to flooded rice fields. This naturally adds to the labor of rice production.

When the rice grains begin to mature, the fields are raided by seed-eating birds, often in such numbers as to leave but a small harvest. A common method of keeping the birds away is to stretch a number of strings across each paddy, with streamers or pennants attached to them. These flap about when the cord to which they are fastened is jerked vigorously. Small platforms or towers are erected so as to enable a single watcher to guard four plots. This is no small task, because the flock, when disturbed, merely takes wing to descend at another location.

Processing the crop

Threshing rice involves two operations. As in oats, a hull or husk firmly encloses each grain, and this must be removed by rubbing or gently beating the grain in a mortar or upon a mat. The most primitive way is to tread barefoot upon the unhulled grain.

The next step is to separate the detached hulls, or chaff, from the grain by winnowing. The usual way is to scoop the trampled mass into a shallow basket and toss it into the air above a mat or sheet. The heavy grain falls straight down, while the chaff is floated to one side by the gentlest of air currents.

For the most part the hulled grains of rice are not white but are covered with a coat of brown, which can be removed by rubbing or beating, a process called "polishing." However, many native rice-growers dispense with this procedure and eat "brown rice" instead. The food value of rice is decreased by polishing, yet custom regards white rice as preferable.

In the Philippines, as in many other parts of the rice area, hillsides are

Fenno Jacobs, from Three Lions

▲ **Beating rice** to separate the kernels from the husks, in the Philippines

utilized by the construction of terraces, or walled-in shelves, extending horizontally one above the other. These are flooded with water in the rainy season. The magnitude of these terraces, covering the landscape from valley to hilltop like a gigantic series of hanging gardens, is impressive. The prodigious task of keeping them in order means that the owners make rice-growing their chief concern. Hand labor prevails, with the simplest mechanical appliances, — little more than digging sticks, crude wooden shovels, and the bare hands. The plow, first developed by wheat farmers, seems to have been introduced by the Spanish conquerors of the Islands.

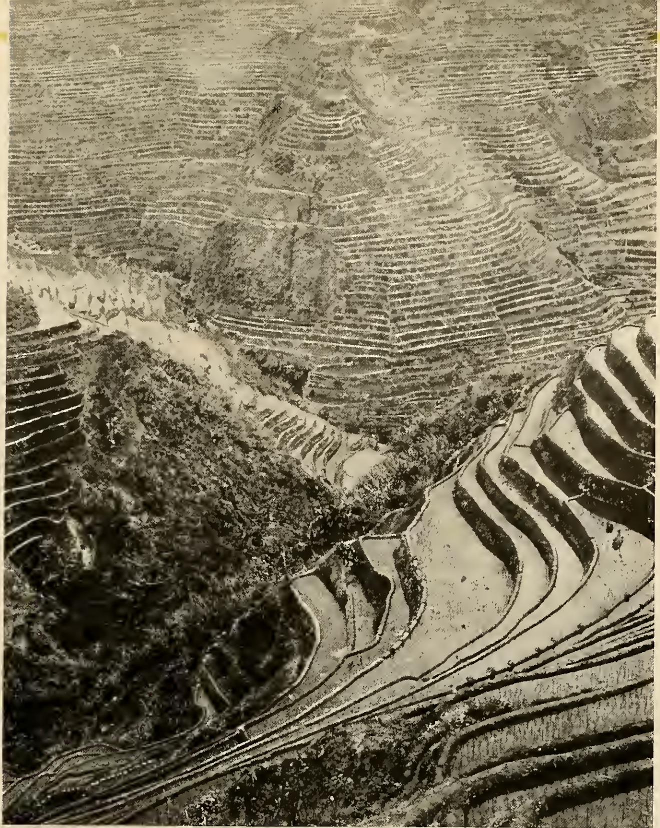
Since 1500 A.D. the cultivation of rice has been introduced into many tropical and semitropical areas, such as southern Europe and North Africa, and parts of west Africa, southern United States, certain localities in Mexico, Central and South America, and many Pacific Islands, including Hawaii. The annual production of rice in the United States is about 70 million bushels, or about one-fourth the barley crop. This amounts to about one-half bushel per capita, but since cooked rice expands 300% in bulk, the amount is of some importance.

North American wild rice

Our story would not be complete without some account of wild rice in America. This is a different genus of

▼ **After** the rice is hulled, it must be winnowed. The kernels fall to earth and the chaff floats away

Alfred T. Palmer photo, from Black Star



➤ THE LABOR of tending hillside rice terraces like these and of keeping the dikes in repair can easily be imagined: a scene in Ifugao Subprovince, Luzon, in the Philippines, where human life revolves about the growing of rice.

Theodore Roosevelt, Jr. Collection, A.M.N.H.

rice, *Zizania aquatica* and Z. *milicea. Aquatica* grows in single stems, five to ten feet tall, with panicles about two feet long. The glumes (husks) are about an inch long, containing long slender grains, of a dark slate color when ripe. The plants can adapt themselves to quiet water, two to eight feet in depth, preferably the margins of ponds, lakes, or flood plains of rivers with mud bottoms. Early in June the shoots appear above the water. They mature about August 1st, and the grain is ready for gathering in September. The early French explorers speak of this wild rice as wild oats, Indian oats, etc.

The plant is an annual and seeds itself, since the ripe grains are heavy and sink to the bottom when they fall. The main habitat of Z. *aquatica* is the part of the United States and southern Canada east of the 100th meridian west, an area roughly east of a line passing through Pierre, South Dakota, Dodge City, Kansas, and Abilene, Texas. The Indians who made the most use of wild rice were those of eastern Canada around the Great Lakes and Winnepeg drainage areas, tribes speaking Algonkin and Siouan.

A similar Asiatic species, Z. *latifolio,* has been observed in Siberia, Japan, Formosa, and part of eastern China. Although Z. *aquatica* is reported from the West Indies, it is not known in South America.

None of the North American Indians seem to have *sown* wild rice until after contact with white people. Since 1800, some of them are known to have stocked lakes and ponds when necessary, but once the plant was introduced, it needed no cultivation.

The only attention the early Indians gave the crop was to tie the rice heads in bunches to protect the crop from birds and to prevent the wind from shattering out the grains. For this, they made twine of basswood

WILD RICE, native to North America, was an nportant source of food to many Indians. It ourished without cultivation in the margins of kes and on the muddy floodplains of rivers nd was harvested in September. (Potomac iver)

Fish and Wildlife Service photo

bark fiber. Each woman, or family, used a slightly different tie and accordingly claimed ownership of the ripening rice.

The rice was gathered from canoes, poled or paddled among the rice stalks, the bunches of heads being bent over and the grain beaten off into the boat, as shown in one of the illustrations. The earliest accounts of rice gathering (1689) mention tying the heads but make it clear that much of the rice harvested was not tied but merely bent over the edge of the canoe, as shown in the drawing by Eastman. When a canoe was filled, it returned to camp, where the load was spread upon drying-frames.

The grains had then to be hulled by treading or beating. According to tribal custom, there were varying stages in these processes, since the drying frames might be smoked, the grains parched in a kettle, etc. The wild rice you purchase from your grocer has a smoky flavor if prepared in the Indian way.

Note that the main procedures in preparing wild rice closely parallel those for cultivated rice in the Old World. The two important differences are that in Asia rice is not tied in bunches to protect it from birds as was wild rice in America, and it is not smoked. On the other hand the American grain is not polished. In both areas the laborious processes are harvesting, hulling, and winnowing the grain. Like the Asiatics, the Indians almost never ground their rice but ate it boiled, usually with meat of some sort and frequently sweetened liberally with maple sugar. The Indians did not plant and weed their crops, but the labor of making twine and tying their rice was by no means a light task. Gathering the basswood bark and preparing the twine by hand occupied the spare time of the family during the winter months. We have estimated that from two to six miles of twine were needed by each family, the number of bunches tied ranging from 400 to 1600.

A world view of man's plant foods

The plant foods of man are embraced under a few main classes, as (A) cereals, (B) root crops, (C) fruits, and (D) vegetables. The cereals, or grains, head the list: wheat, barley, rice, rye, oats, the millets, and maize. All are the seeds of grasses. It appears that the period during which man merely gathered the wild foods that nature offered at the time and place, without cultivating the plants, was by far the longest span of time in human existence. During this long primitive period man overran all the habitable parts of the earth and met up with almost every variety and species of seed-bearing plants. The opportunity for experiment was almost boundless. In turn, the habitats of these grasses were spotty and highly localized. By trial and error, man probably came to recognize the most important species of seed-bearing plants in his habitat and sought to devise more and more convenient ways of gathering, processing, and cooking them.

Even from the first he seems to have been a *gourmet,* putting himself to a bewildering routine of trouble and toil to improve the raw products offered by nature. His fellow creatures were content to take seeds as they found them, but not he, as in the words of the most ancient of sages, "He prefers to earn his bread by the sweat of his brow." Even the way of the savage is the hard way. Hours and hours of patient toil are given to the preparation of what is eaten in a few minutes.

Fortunately for us, not all peoples of the earth became civilized at once. The understanding of our subject is made possible by comparing the ways of the nonagricultural peoples with the civilized. Thus in the United States we can still observe Indians gathering seeds as they did centuries ago, particularly in the semidesert lands of Arizona, Utah, Nevada, and southern California. The Paiute tribes, armed with simple ingenious basketry devices, strip seeds from many species of wild grasses, winnow out the chaff, and store the tiny seeds for grinding into meal and eventually baking in cakes, or more frequently for thickening soups. Seeds of more than 50 species were gathered by the Paiutes alone, which about exhaust the list of local wild grasses. Civilized men and women will not bother themselves over such small returns for the labor involved.

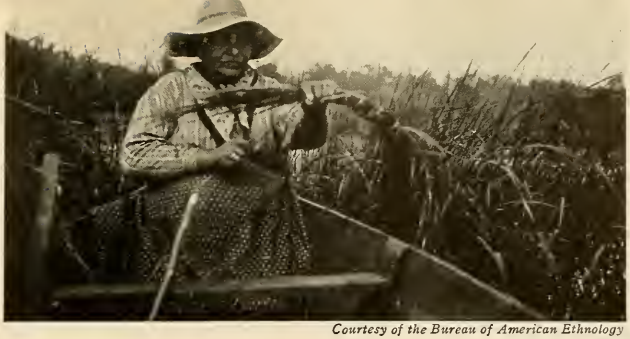
In a large part of semiarid Australia, where there is sparse vegetation and grasses, it is not surprising that the natives recognize the food value of even the smallest seeds. They carefully gather and conserve them, grinding them between stones and making cakes with the meal. It should not be overlooked that arid lands also bear numerous root plants whose bulbs are dug out with digging sticks. This is true in Australia as well as in the habitat of the Paiute Indians. Thus the popular contemptuous name "Digger Indians" is said to have been applied to many tribes west of the Rocky Mountains because they were so often seen digging in the ground for food. Some Australian explorers have written that the ground around a native encampment was so upturned as to suggest that a drove of pigs had been rooting up the place. Even Captain Lewis (of the Lewis and Clark Expedition) found the Nez Percé Indian women who were camped along the Columbia River so busy pounding roots that the noise reminded him of a nail factory.

But we are now concerned with cereals or seed grasses. We have reason to suspect that a long period of experimentation with wild seeds was necessary before success was achieved in producing the world's three great staple foods — bread, (wheat, barley, and rye), hominy (maize, hulled by boiling in wood ashes), and a bowl of boiled rice. Partly because of the large role that grasses have played in providing food for man, the semiarid lands are more often thought of as the place where agriculture began. Many root crops seem to stem from forest flora, but not all of them do. Tree-crops are chiefly of forest origin, but man probably planted grains before he planted anything so slow-growing as a tree. Plants of aquatic origin, including rice, tend to have forest homelands, but grains of the millet-wheat group seem to have been native to uplands tending toward aridity. Further, their cultivation appears to have been more ancient than rice. It is therefore most probable that the cereals and civilization developed in favorable spots in a semiarid environment and that the development of rice was stimulated by the successful exploitation of wheat. These assumptions are at least consistent with the locations of the earliest known civilized towns of any size. Civilizations are not conceivable without relatively dense populations, which in turn depend upon agriculture.

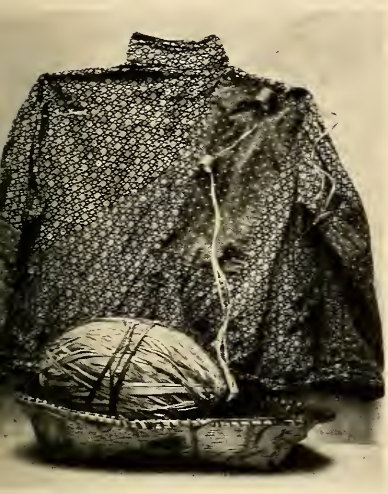
The archaeology of agriculture

The archaeology of plant foods, wild and domesticated, is only beginning to unfold, but the world is awakening to its importance and there is promise of new knowledge, like the

➤ Chippewa Indian in boat, tying wild rice. To protect the rice from birds and wind, the Indians laboriously tied the heads in bunches. Ducks of every variety, geese, and birds of all sizes and kinds found millions of acres covered with this pleasant food, while the Indians could gather but a small quantity, according to Mrs. Eastman, who described the aboriginal scene in 1853

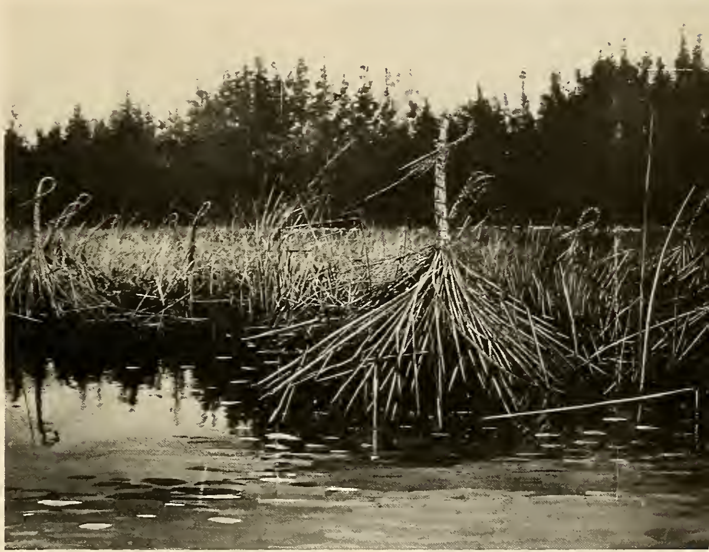


Courtesy of the Bureau of American Ethnology



◄ The binding twine was threaded through rings attached to the jacket the woman wore when tying wild rice. From two to six miles of twine are estimated to have been needed by each family for tying one season's wild rice. Customarily the twine was made by shredding out long slender ribbons of basswood bark fiber and tying them together (From the Chippewa Indians)

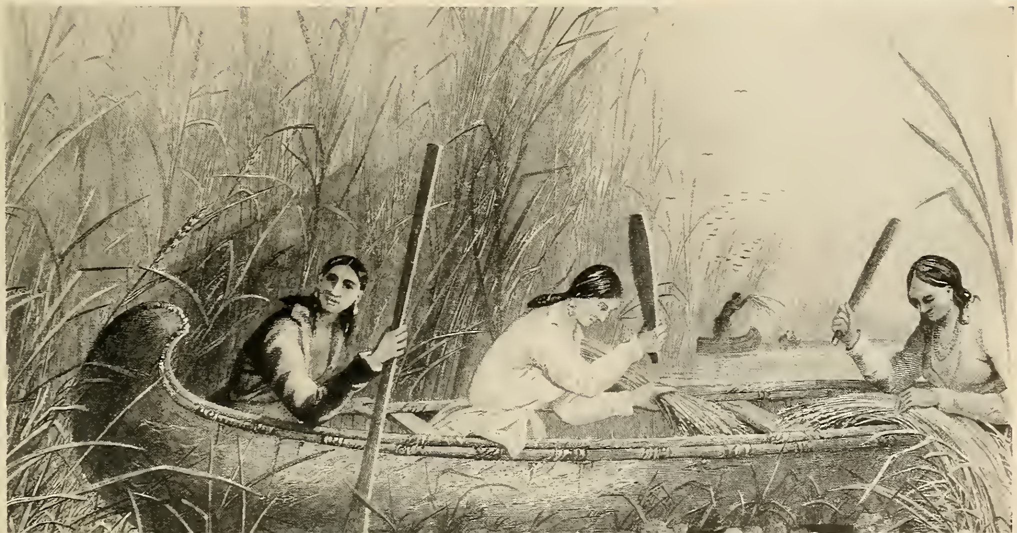
Photos courtesy of the Bureau of American Ethnology

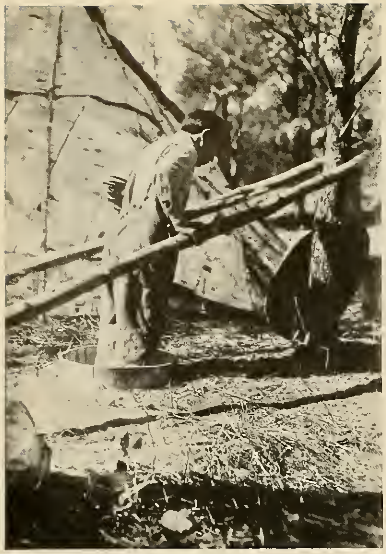


➤ A narrow bed of wild rice tied in bunches or sheaves

▼ When the wild rice was ripe for harvest, the grain was beaten into canoes as shown in this drawing by General Seth Eastman, dating from the middle of the last century. To quote from Mrs. Eastman, the girls from an Indian village made quite a frolic of it

Eastman's Aboriginal Portfolio



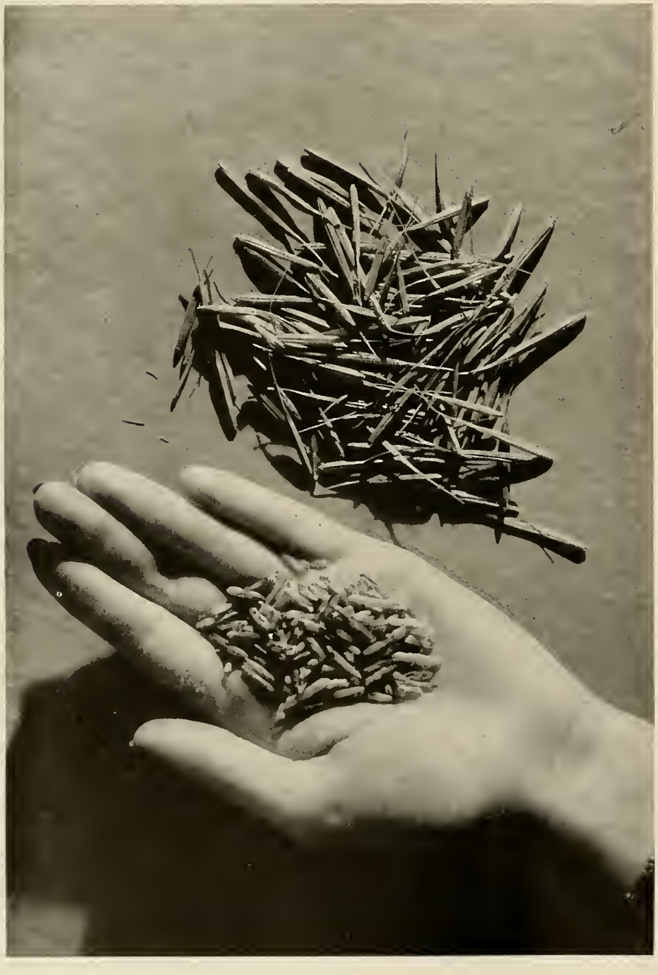


◄ **The processing of wild rice** in America was in many ways similar to that of cultivated rice in the Orient. Here we see a Chippewa Indian treading rice in the familiar manner to remove the husks, but with two railings to take some of the weight off his feet

Courtesy of the Bureau of American Ethnology

▼ **Wild rice** from the country of the Ojibway Indians: above, threshed but not hulled; below, hulled and ready for storing or cooking

A.M.N.H. photo



twilight before a glorious dawn. Within another decade or two those who survive us will write a thrilling account of this new chapter in the science of man. Even now scraps of information are worth citing. We recall one of the latest contributions to the knowledge of plant foods of early man. Most of you have heard of that famous cave in China in which were found the remains of Peking Man. Embedded in the debris of that cave were masses of cracked shells of seeds which botanists have identified as hackberry (genus *Celtis*). A modern form, *Celtis occidentalis* var. *crassifolia,* still grows in western United States, especially in semiarid districts. Similar hackberry seeds are found in deposits of the Pleistocene or Ice Age in South Dakota and in north China. The mere presence of the cracked seed shells in the cave does not prove that they were eaten by man. Rodents could have carried them into the cave. However, Ralph W. Chaney of the University of California sought to solve this problem in a scientific way. He offered modern hackberry seeds to rodents and monkeys of several different species. Most of the rodents ignored them, but the few that ate them merely gnawed small holes into the shells to extract the kernels, whereas the shells in Pekin Man's cave were crushed to fragments. The monkeys chewed the seeds and spat out the shell fragments, which were similar to those in the cave, but there is no archaeological evidence that monkeys lived in the vicinity of the cave when Peking Man was there. Since even modern Indians in western United States eat hackberry seeds, Professor Chaney gathered information from them. He found that their method was to crush the seeds between stones to secure the kernels and that the resemblance of these fragments to those from the cave approached identity. We do not know whether Peking Man chewed the seeds or crushed them between stones, but since he used simple stone tools, it seems fair to assume that he gathered hackberry seeds and carried them home to crack at his leisure.

Diggings by archaeologists almost everywhere have brought to light the charred remains of grasses and seeds, and botanists have usually been able to identify them. In the previous articles on wheat and maize we have mentioned such findings. In the submerged remains of Swiss lake dwell-

➤ All of the world's modern production of wheat, corn, and rice has grown out of the primitive occupation of collecting grass seed. Today we can still see this elementary activity among the naked, hungry Australian "blacks," as shown in these drawings. For thousands of years, primitive women have thus gathered food—a seed or two here, another there—at great cost in toil and patience and with a return so trifling as to transcend belief

ings were found charred and natural remains of many cultivated plants, including wheat, barley, rye, oats, millet, celtic peas, and carrots. By such finds it has been possible to distinguish between the horizons of agricultural and nonagricultural peoples.

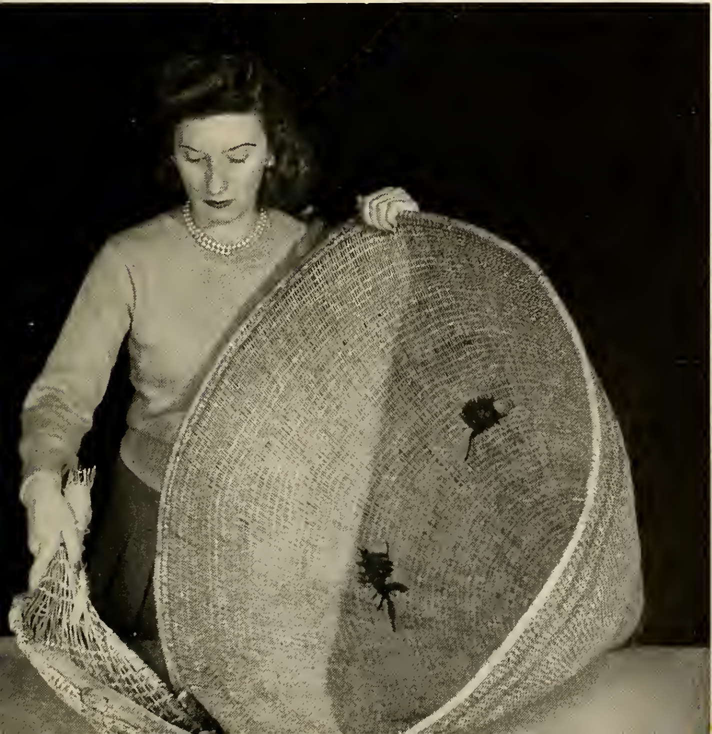
In the New World we now find special published articles on the prehistory of cotton, beans, peanuts, sunflower seeds, gourds and squashes, tobacco, maize, etc., each a fascinating chapter in the unwritten history of the world. One conclusion to be drawn from such data for the United States is that other kinds of agriculture were practiced in Kentucky, Tennessee, Missouri, and Arkansas long before maize was introduced into that region. In fact, the last crops to appear were maize and tobacco. Long before they were grown, sunflowers, squashes, gourds, and seed plants were a part of the agricultural economy of the tribes. A recent publication by George F. Carter* tells how the new data resulting from preserved seeds and fragments of the *Cucurbita* (gourds, squash, pumpkin, etc.) suggest that their cultivation in southeastern United States long preceded maize in the same area and that they found their way in pre-maize times into New Mexico and Arizona. In general, this new information fully justifies the belief that agriculture in the New World was developed independently and without influence from the Old.

Our younger readers can look forward confidently to the time when a much more complete story of man's achievements with plant foods can be written.

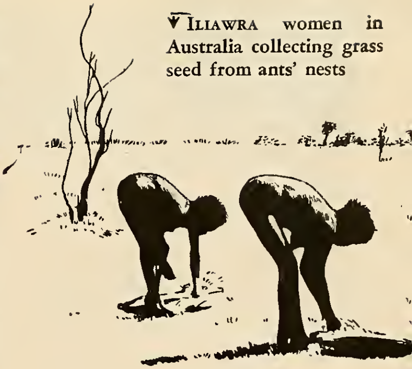
***Plant Geography and Culture History in the American Southwest*, Viking Press, 1945.

▼ A seed-gathering basket and beater from the Paiute Indians of Nevada. The basket is shaped so that the edge can be held low and the grass stalks bent over it and shaken by the beater. Again, the beater may be used to catch falling seeds and transfer them to the basket

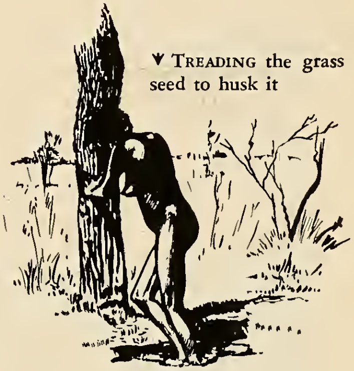
A.M.N.H. photo



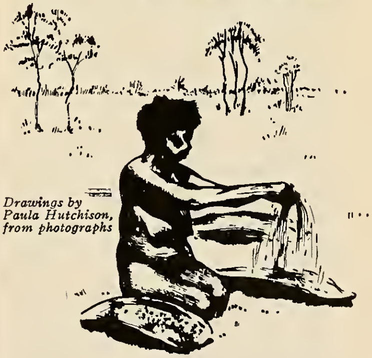
▼ Iliawra women in Australia collecting grass seed from ants' nests



▼ Treading the grass seed to husk it



Winnowing the husked grass seed



Drawings by Paula Hutchison, from photographs

The simple but exacting routine of converting grass seeds to food is everywhere the same: (A) find the ripening seed, (B) strip the grain from the stem, (C) hull it by treading, (D) winnow out the chaff, (E) pulverize the seeds, (F) combine with water to form a paste, (G) bake or toast on a fire

"Transplanting" animals sounds simple enough, but moving Rocky Mountain goats provided much excitement and hard work for nature lovers in Washington, Idaho, and Montana

By DALE WHITE

TRANSPLANTING is a term only too familiar to gardeners. But transplanting as applied to mountain goats meant plenty of excitement and hard work to nature lovers in Washington, Idaho, and Montana.

It was a case of too many mountains and too few goats. Prolonged inbreeding and a scarcity of forage were slowly but surely erasing this picturesque animal from the roster of American wildlife. The chance that the goat might seek to save himself by moving to other mountain ranges and mingling with other herds was practically nil for two reasons: it has taken centuries for the mountain goat to filter southward from his natural habitat in remote British Columbia, and he has a definite aversion to the lowland plains and valleys he must cross in order to reach the icy alpine sedge of neighboring rocky heights.

Thanks to some conservation-minded men who were willing to tackle something new and adventuresome in their efforts to transplant Rocky Mountain goats (as well as the nearly extinct Rocky Mountain sheep), the goats not only have a better chance of survival but have been brought within closer sight of hikers, candid camera fans, and vacationists. Hunting is extremely limited.

Although the transplanting projects in the three states are conducted along similar lines, the one instituted by the Rod and Gun Club of Big Timber, Montana, with the help of the state fish and game commission is the most extensive. The crop of calluses that Bob Cooney and his crew displayed for months was ample evidence that the job was a tough one. As director of the state wildlife restoration division, Cooney had the task of figuring out how the job might best be accomplished.

On a rocky, wind-swept plateau in the Deep Creek Canyon area south of Glacier National Park, sturdy pine posts were snaked out of the adjoining timber, set in the frozen ground, and enclosed with nonclimbable wire to form the capturing pen. The gates constructed at each end were left open, and the trap was baited with block salt. When the crew returned after a week's absence, it was clear that the goats had found the salt and wandered freely in and out of the pen; therefore the men wired shut one gate and set a tripping device on the other so that it could be closed from a distance of 300 yards.

A second week passed and the crew returned, only to find not a sign of a goat in the vicinity. This meant a long silent wait behind the slight elevation that allowed the crew to watch the trails leading to the pen without being seen. It was a raw, blustery day and the rocky, frozen ground offered little comfort. A chill north wind blowing down off the glaciers detracted from the crew's abounding joy in the beautiful scenery about them.

Late in the afternoon, however, several goats were spotted moving toward the pen. Being goats, they stubbornly refused to walk right into the enclosure but grazed annoyingly outside. The boys watched in agonized and chilly suspense. Finally two large goats went all the way in. They both appeared to be males, so the gate could not be closed until more stock of varying age and sex appeared. Just about dusk a mature nanny and her yearling kid appeared and, after the usual delay, sauntered in.

The gate was dropped.

At first the four goats huddled together at the back of the pen; then they experimented with running around and butting, although not injuring themselves. The next morning four crates were hauled up the steep mountainside leading to the level plateau, by means of a mule team hitched to a two-wheeled trailer. The crates were placed inside the pen, one end flush with the back of the enclosure. Now all the boys had to do was to get the goats into the crates.

▲ Two of the crated animals are being transported downhill by pack horse. Their heads have to be tied to prevent their slashing the pack animal or the crew

➤ THESE picturesque animals faced near extinction until conservation-minded individuals thought of transplanting a limited number into desirable new areas

Roping mountain goats from a lofty and insecure perch atop a wire fence requires considerable dexterity and tenacity: the dexterity for roping, the tenacity for sticking to the perch without being yanked to the ground by 170 pounds of bucking, plunging goat. The roping was done from above since the sharp horns were an unknown factor well-worth avoiding.

When the first goat was roped, Cooney dropped into the pen and passed the free end of the rope through the crate and out of the pen. Then it took two men to pull the goat into the crate. By dint of much hard labor and considerable agility, the remaining three crates were filled and mounted in the trailer for the downhill trek. The gate was opened and the tripping device set again, since more goats were needed for the first year's plant.

Easing the trailer down-mountain called for more co-operation between the mules and men, but finally the crates were transferred to a pickup truck and the 335-mile trip started to the point of release in the Sweet Grass Canyon of the Crazy Mountains Range. The goats weren't too obstreperous but stamped and pawed the bottoms of the crates in defiance rather than fear, whenever spectators gathered around. Crowds gathered each time the truck stopped, and the goats viewed the humans with matching curiosity. Although cautioned repeatedly, several onlookers managed to pet the yearling through the crate, only to be rewarded by the rivet-like buffeting of his short, sharp horns.

The desired scientific information was obtained by easing the goats out of the crates, approaching them from behind, and throwing them so they could be ear-tagged; they were then suspended in a sling for weighing, measuring, and examination. Although a good number of Big Timber citizens turned out to help with this supposedly strenuous duty, it was easily done. By now the unpredictable goats were playing 'possum so convincingly that the crew wondered if the transplanting had been too much of a shock and caused the goats to go into a quick decline.

When they were carried 25 yards up on the side of the foothills and freed, the goats played dead for some time. They slowly raised their heads, looked about cautiously, and then streaked away. Ten days later eight additional goats were transplanted. The only variance in procedure was that the crew now had the goats' measure and were willing to rope them on foot, and they found it easier to trans-

Transplanting ROCKY MOUNTAIN GOATS

All photographs by the author

port the crated animals down-hill on pack horses. In the same manner, successful transplantings were made in two other Montana areas widely separated but capable of supporting this animal, and also in neighboring Idaho and Washington. The projects will continue with yearly surveys for winter survival and increase.

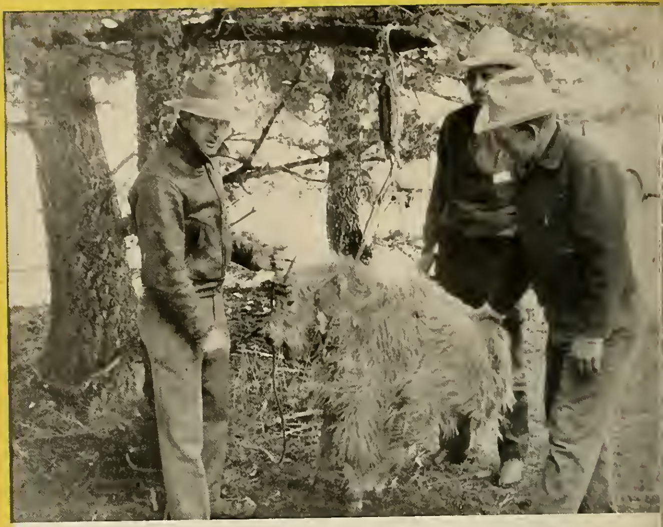
The natural range of the mountain goat within the United States apparently has changed little from that of historic times. Captain James Cook gave the earliest recorded intimation that such an animal might exist when he mentioned having seen native spun-wool garments on his visit to the Alaskan territory in 1778. Lewis and Clark refer to it in their journals, and scattered accounts were brought in by fur traders; but until about 1880, the white Rocky Mountain goat was more a myth than an actuality.

It is a known fact that natives of the north country gathered the wool from bushes or from dead goats and spun it into blankets and rugs that vie with the Navajo articles in design. The fleecy undercoat is snow-white, as fine as merino wool, and three to four inches long. The horns, effective daggers in head-to-head combat, average nine inches and are valued as curios when inlaid and carved into spoons.

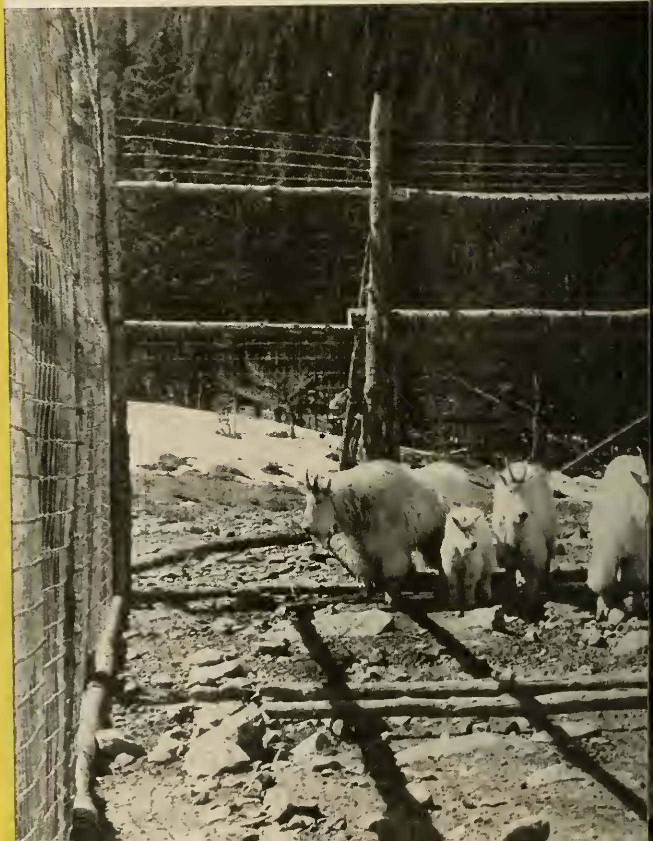
The fur traders left the goat alone. Possibly his escape from near extinction is due to his frequenting higher altitudes seldom invaded by the rapacious trappers of the past century. His worst enemy is the snowslide or avalanche. Eagles prey on the young kids, so the nannies keep their offspring close to them and near overhanging rock ledges until they are large enough to ward off such attacks. A kid born in captivity was observed to get to its feet ten minutes after birth. It jumped and climbed over its mother in the next ten minutes and nursed soon after. In the natural state, the kids are unusually strong and amazingly active on the rocks.

This goat ranges on rough rocky terrain near and often above the timber line. He knows well the location of dry caves, since exposure to a drenching rain will waterlog his coat and subject him to pneumonia. The most extreme cold appears not to bother him in the least.

It seems impossible that this spry bit of quicksilver, which can balance above a sheer chasm on a rock the size of a dinner plate, could find



▲ SUSPENDED in a sling from spring scales, this goat is weighed, measured, a
examined



▲ AFTER the goat was roped, it still took two men to pull him into the crate

▼ TWO BILLIES, a nanny, and a kid. This is part of the group captured in the mountains south of Glacier Park and used to start new herds in other parts of Montana

enough to eat on the deserted, snow-blown summits of the mountains. The animal can paw through deep snow for forage if he has to, but prefers to climb to higher areas where the strong winds blow the snow off the ground. He likes aspen and birch, lichens and grass, and feeds early and late in the day, chewing his cud between-times and often sitting on his haunches like a dog. In the spring he seeks the mineral salt licks and indulges in rowdy dust baths. He sheds late in June, great shreds of the white wool hanging loose until pulled away on snaring bushes. He has been known to engage a bear in combat, killing the huge beast by piercing the heart with his horns before the bear could break his back with one savage blow.

The Harney Peak in the Black Hills of South Dakota, highest point east of the Rocky Mountains, boasts a considerable sized herd acquired quite by accident. In 1924 six goats were brought to the Black Hills to be included in a North American big game exhibit at Custer State Park. The goats escaped shortly to the Harney Peak area, where they prospered and multiplied in a Ponderosa pine belt considerably lower than their usual habitat.

Woodsmen will tell you that the meat of a full-grown billy is tough and strong, while that of a kid is very sweet and tender. An oldtime ranger admitted that no amount of cooking would ever tenderize a billy-steak and that the only way you can eat it (which you wouldn't do unless facing starvation) is to cut it in half-inch chunks and swallow quickly before it swells into an indigestible mess.

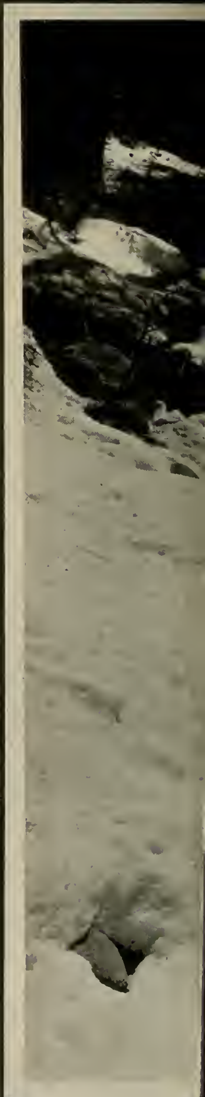
Outdoor enthusiasts and photographers like this snow-white animal because he is picturesque and a natural part of mountainous country. He is easily seen and not at all furtive. He doesn't try to hide, because he doesn't have to. The perilous crags and rocky inclines keep him at a safe but pictorial distance as he delights and astounds those who watch him scramble up almost perpendicular inclines, jump over chasms, and pose unconcernedly on some needle-point crag.

Show-off and clown though he is, the Rocky Mountain goat deserves to be protected. Any animal whose antics and appearance so thrill nature lovers should be given greater distribution and encouraged to be less of a rarity and more of an accepted attraction in the mountains of the West.

W

". . . . the trees, all spectral
and still and white . . ."

From Snow, by Elizabeth Akers



ter comes to rule

By JOSEF MUENCH

. . brooks and ponds in crystal bonds . . ."

From Old Winter, by Thomas Noel

"...born of the soft an
slumbrous snow . . ."

From Snow, *by Elizabeth Aker*

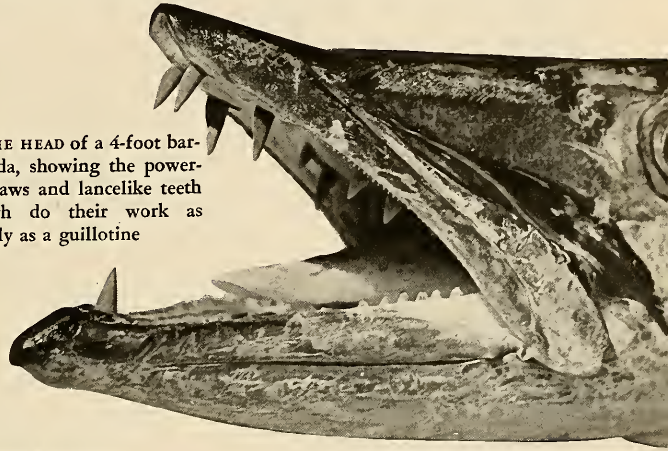
". . . enrobed in
timeless snows . . ."

From Kinchinjunga, *by Cale Young Rice*

BARRACUDA–
Tiger-of-the-Sea

Encountered in all tropical and subtropical oceans, this underwater "Jack the Ripper" will attack with terrific speed almost any kind of sea creature

By MYRON GORDON
Assistant Curator of Fishes,
New York Aquarium,
New York Zoological Society



➤ THE HEAD of a 4-foot barracuda, showing the powerful jaws and lancelike teeth which do their work as neatly as a guillotine

Photo by Myron Gordon

THE white shark, or man-eater, has been accused of attacking man, but often the real culprit is the great barracuda. Without minimizing the ability of the white shark, one of the largest and most powerful fishes in the sea, expert ichthyologists agree that the barracuda, the tiger-of-the-sea, is the most dangerous of all marine fishes.

In the West Indies, the colored boy's fear of the great barracuda and his contempt for the shark are described by Frank Bullen, who saw a group of eight Jamaican natives dive into deep, clear water to recover a heavy iron chain that had fallen from the dock. As they swam and worked in the transparent sea, the Negroes cared no more for the shark than they did for a herring. But when someone spied a barracuda and yelled "*Couter! Couter!*" they became completely demoralized, swam frantically to the ropes that were flung out to them, and struggled with all their might in a panic-stricken rush to get out of the water.

On June 1, 1924, Anthony Sjalkiewicz, a carpenter's mate third class in the United States Navy, together with a group of his friends who were trying to cool off, went swimming in waters off the sun-scorched Coco Sola Naval Base on the Atlantic side of the Panama Canal Zone. Fifty yards off shore, just when his right leg was flexed for a kick, something from behind grabbed him. The other sailors had gone back to shore, and Sjalkiewicz realized from the commotion about him that some large fish was alongside. At first he was aware of no pain, but he soon felt the sting of the bite, and then he knew that he was badly hurt. He screamed for help, but before those on the beach knew what the shouting was about, he managed to struggle close to shore.

He was rushed to the Colon Hospital, where his wounds were washed, drains inserted, and the terrible gashes stitched together by the staff doctors.

The Sjalkiewicz case soon was the talk of the hospital staff, and the discussion centered around the nature of the beast that was capable of inflicting so injurious a cut. The peculiarities of the gashes were studied, and Captain Bronson ordered photographs to be taken for the records of the United States Navy. Three likely suspects were mentioned: the shark, the barracuda, and the crocodile, all of which were known to be in the vicinity—but the crocodile was soon ruled out.

The case of the mysterious attack was not solved by a doctor of medicine but by a doctor of science, a man who happened to be a patient himself at the Colon Hospital. Dr. Charles M. Breder, Jr., then Research Associate of the New York Aquarium and the American Museum of Natural History, had come down with malaria while in Panama's Darien Jungle.

He obtained permission from the superintendent of the hospital to see the victim and to study the gashes. He pointed out that the deep gashes were straight and clear-cut, not widely curved or jagged. The shape of the wound and the manner in which it was made, he explained, called for a straight jaw and long and lancelike teeth capable of a shearing effect. These the barracuda alone has.

Later, in a report to the American Medical Association, Dr. Breder, with the aid of a barracuda specialist, Dr. Eugene Willis Gudger, who had spent several years studying the voracious fish at Dry Tortugas, Florida, reviewed the Coco Sola incident and analyzed in detail the various types of injuries that each of the three sea beasts might inflict on man.

If a person were bitten by a shark, the lacerations inflicted would be less penetrating but more jagged in outline, because the shark's teeth are like sharp pyamids—not stiletto-like. Each would be curved in outline, and the crescent left by the jaws would be quite wide. Finally, the shark if it strikes its prey once, will strike it again and again. A 10-foot white shark (*Carcharodon carcharias*) weighs over 1000 pounds, and one 30 feet long was reported to have swallowed a fair-size young seal at one gulp. No—it would be foolish to minimize the powers of this species of shark, but fortunately they are never numerous at any one place.

The barracuda's power of vision is keen. Anyone who has seen its large, wicked, staring, black pupil senses the fish's evil eye. It is attracted to its victims by any unusual activities on their part. A swimmer splashing at the surface is particularly likely to draw its attention. A fish hooked on a line, swerving from side to side, fighting to shake itself free, is practically jumping out of the frying pan into the jaws of a barracuda. I have gone fishing for yellowtails and gray snappers with hook and line, and invariably, at least once a day, after getting a bite and hauling in the line, I'd pull in nothing but a quivering head. We knew then that barracudas were around—no other fish could have done such a neat, straight-as-a-guillotine job. But barracudas have their weak moments too, and it was easy to tempt and hook them with the same fish-head they had missed a few minutes before.

Knowing the barracuda's insatiable curiosity about anything that has a peculiar glint or movement, the Maoris of New Zealand have worked out a scheme for catching them easily. Frank Bullen saw them fasten a fishing line to a ten-foot pole and at the free end of the line attach a piece of smooth red pine, four inches long, one inch wide, and a half-inch thick. When the pine board is wet, it becomes brilliantly crimson. The final touch to this contraption is a two-inch sharp, up-bent spike that is driven through one end of the bright board. Two fishermen work together; one sails the boat briskly, the other handles the trailing lure. The barracuda snaps at the bait, and the Maori simultaneously swings it aloft and drops it into the boat, while his sailing partner lets the peak halyards fall. The fish is freed easily from the barbless hook, and the game is repeated. Florida reefers splash rags in the water to attract barracudas, and then catch them by using a flashing trolling spoon.

The meat of the barracuda is reputed by some West Indian natives to be poisonous, and the sickness resulting from eating it, which some claim is often fatal, is known as *ciguatera*. Just the same, barracudas are caught in great numbers for food. At the Dry Tortugas Carnegie Laboratory for Marine Biology, our sailors, mechanics, general helpers, and caretakers—all of them Florida reefers—always had a string of large barracudas on the dock, hanging in the brilliant sun to dry. They said it made excellent jerked-beef. L. L. Mowbray of the Bermuda Aquarium claims that if the fish is dressed just as soon as it is killed, there is no danger of poisoning. Like many tropical species, the toxins are not in the muscle meat but in either the sexual organs, liver, spleen, or in all of them. In the early days, carelessness and the lack of refrigeration accounted for many of the cases of *ciguatera*. A number of quaint tests were devised to test the wholesomeness of the fish, which when fresh is declared excellent in flavor. Cuba's greatest ichthyologist, Dr. Felipe Poey, suggested about 100 years ago: "One may eat it with full security if one in advance tries it on a cat." There has been no improvement on this test today, even in the most up-to-date laboratories. The French authority on venomous

▼ A baby barracuda, about two inches long. Barracudas only half an inch long have been found in the surface waters far from shore, but the breeding habits are not fully known

Photo by Myron Gordon

fishes, A. H. A. Duméril, offers another test: "When a silver spoon or coin, placed in the vessel in which the fish is being cooked, does not become blackened, the flesh may be eaten without fear,"—but this has not been confirmed.

The barracuda is found in all tropical and subtropical waters around the world. Aristotle knew and described it in his Historia Animalium; he named it *Sphyraena*, and *sphyra* meant a pick-hammer to the Greeks. Along the Mediterranean the Italians, French, and Spaniards call it *spet* or *spetto*, alluding to the sharp-pointed head. Australians call their toothy species the *dingo*. Many years after Aristotle, Johann Walbaum in 1792 gave it the specific name *barracuda;* and this has many popular variations, such as *barraconta, parracoota, picuda,* and *becuna,* and of course the Jamaican's *couter*. In the Florida keys the favorite name, other than barracuda, is the tiger-of-the-sea; and it certainly is that. This torpedo-shaped fish has been known to reach a length of eight feet and a weight of slightly over 100 pounds. L. L. Mowbray says, "While it is cruising, its movements are slow, and its habits of hiding under floating objects reminds one of a submarine lurking in the steamer lanes ready to strike down a passer-by. It will attack with terrific speed almost any kind of a sea creature, its own species included, no matter what the size, and with one snap it can sever the body of an unbelievably large fish."

Like its counterpart of the jungles, the tiger-of-the-sea may be trained to docility. Mowbray tells of a captive barracuda in the old Miami Aquarium: "One of the aquarists would pet the barracuda, much as a child would stroke the back of a cat, and the fish would, in a seemingly gentle way, take food from his hand." But hundreds of tigers have been taken and trained to the few tigers-of-the-sea one sees in all the aquaria of the world. They just don't like being man-handled. They have to be the kings of their domain, or they perish.

Dr. Gudger, when he was gathering notes at the Loggerhead Key for his monograph *"Sphyraena barracuda,"* saw below the laboratory wharf a four-foot barracuda herding a school of gray snappers, yellowtails, grunts, parrot fishes, angelfishes, surgeon fishes, cock-eyed pilots, and others. "Not one of them," he remarked, "dared make a break for liberty." The school scattered only after Dr. Gudger had chased the terror of the sea away. This habit of herding its prey, he says, may be the barracuda's method of keeping a ready supply of food, or else, "being thoroughly savage and bloodthirsty, it enjoys the game." The barracuda standing guard over a herd of fish will "nearly always be found to have its broad forked tail slowly waving from side to side, vibrating very like the tail of a cat watching a rat hole."

Several years later at the same place I saw a somewhat similar performance of "herding," but this time some of the actors were different. A school of many thousands of two-inch silversides (*Menidia*) were swimming in dense formations like a huge flock of pigeons circling around their loft. There were so many small fish that they seemed to be more like a lot of narrow steel filings arranged about a propulsion magnet. In this instance the magnetic force was a two-foot needlefish (*Strongylura*) and each time it moved ever so slightly to bridge the gap between itself and the multitudinous items of its prey, the whole silverside congregation adjusted itself with perfect timing and sense of distance to recreate the *status quo*.

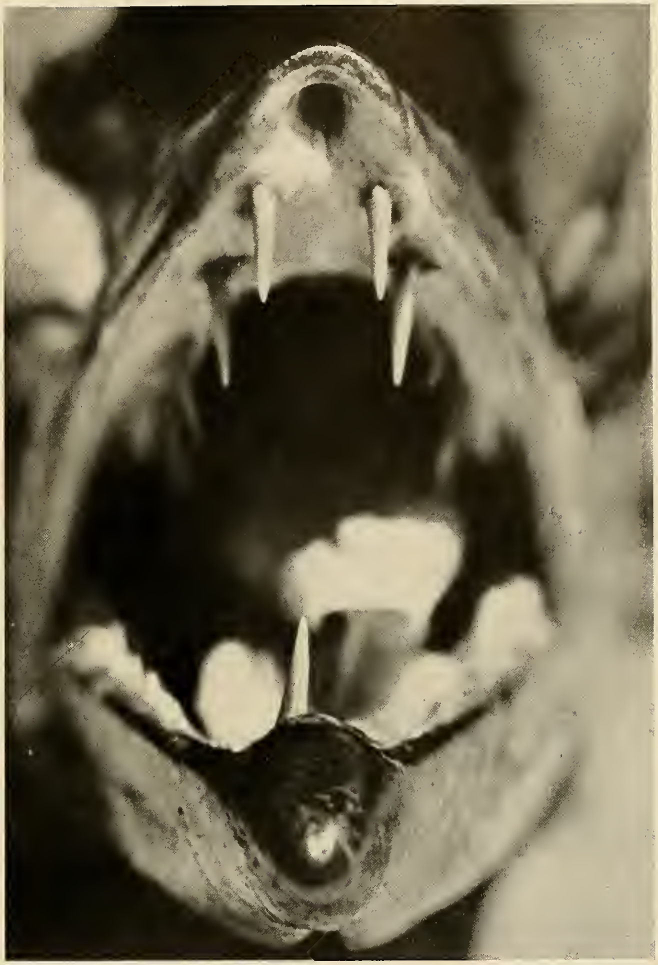


Photo by Myron Gordon

▲ MANY BARRACUDAS have only one large canine tooth instead of two in the lower jaw. These teeth fit into the indentation in the upper jaw

Photo by Myron Gordon

▲ Florida reefers working at the Dry Tortugas customarily dried many barracudas for food. If the fish is dressed as soon as it is killed and if certain organs are discarded, there seems to be no danger in eating it

At first this sort of behavior seemed aimless, but gradually the silverside herd was crowded closer and closer to shallower water. Finally they were forced into water so shallow that their fins emerged, and then even the gentle surf threw them upon the dry sand. They jumped back frantically, but they had lost that fine delicate sense of timing; some were injured, all were easy pickings for the needlefish. And then as if out of nowhere a barracuda appeared, and the role of the needlefish was reversed—it was being hunted. Unlike the silversides, the long greenish-blue needlefish made a dash for safety. It threw itself full out of the water like a javelin over the head of the barracuda, and disappeared.

One morning at the Loggerhead Key docks, just as I was about to take my pre-breakfast dive into the translucent sea, I saw a lurking *couter*. He wasn't hunting any fish (none were about); he seemed to be waiting for me. I ran back to the land and kept running along the quiet sands to our swimming beach about 50 yards away. That *couter* kept pacing me, never losing me from his sight. It was uncanny. I tried hooking him, but he was too smart and swam away.

The breeding habits of barracudas are still unknown, but it is suspected that their fertilized eggs are pelagic, floating freely with the currents. Many of the young, some only half an inch long, have been found in the surface plankton, far from shore.

The great barracuda probably spawns in very early spring in the region of the Florida keys, for many young from one to two inches long have been taken in June. We had little trouble in getting one or two of the baby *couters* with every haul of our 20-foot seine in waters only four feet deep along the shore off Bird Key Reef. The tiny fish were exceedingly delicate and required a steady stream of fresh sea water to keep them alive. All the ones we obtained had two small teeth at the

front of their pointed lower jaw. These teeth grow into a pair of fangs, which get so big that the upper jaw is deeply indented to receive them. Many of the bigger fish have but one huge canine a little off-center—the other having been lost, discarded, or broken away. In one of the big barracudas we got, one of the two sentinel fangs was loose and about to fall out. These teeth are reinforced with others of almost equal length, running the length of both the powerful, traplike jaws. Besides this palisade of formidable teeth, barracudas have two additional rows of many smaller, sawlike teeth. The big row grasps the victim and the little rows slice it up—as wicked and efficient a dentary system as has ever been devised for the purpose. Be sure to avoid getting in the barracuda's way. Even when dead it is dangerous; the razor-sharp fangs of one ripped my hand as I was arranging the skull for the picture you see. No wonder the Australians call their toothy barracuda the *dingo* after their wild dog.

One day I met the great barracuda face to face in his own domain, fifteen feet below the surface of the sea. Our meeting was of short duration—just long enough for me to make my getaway. Equipped with a diving helmet and an iron cane, I was half walking, half bouncing along in the colorful underwater garden of the Dry Tortugas of Florida, the home of brilliant, unearthly creatures. A constant flow of air was being pumped into my diving helmet. Low rumbling sounds from the air pump, transmitted along the length of the rubber tube, came down to me from the boat above. I was aware of gurgling noises as huge air bubbles formed about the lower edge of my helmet and escaped under my chin. The bubbles rose to the surface of the blue water, like clusters of wobbling, silvery toy balloons rising to the hazy sky.

I remembered climbing part way down the ladder over the side of the laboratory boat and having the heavy, glass-fronted helmet eased over my head. I remembered the sharp, cutting pain as the edge of the helmet came to rest over my shoulders. I felt awkwardly heavy until I had low-

▼ An aquarium barracuda, two feet two inches long, which had doubled its length in ten months

N. Y. Zoological Society photograph by Sam Dunton ered myself below the water; then I was no longer aware of the weight of the helmet. I hesitated a second, then let go of the ladder.

Above water I would never have attempted a nine-foot drop to land. Below water, just as I let go, I had a fleeting sensation of terror as I drifted downward. There was no jolt when my feet touched the bottom. I found that I was still a bit top-heavy and had to twist my body in order to land upright. I dreaded the idea of landing on my back on some of those spiny sea urchins that studded the white coral floor. I had seen them, and speared them, from our glass-bottomed boat, but this was my very first trip into their world.

A dull, heavy feeling oppressed my ears; I remembered Dr. W. H. Longley's advice and swallowed air a couple of times, and it disappeared. I knew that Dr. Longley, the laboratory's director was only 20 or 30 feet away in a boat, supervising my first excursion, but all I was aware of at the moment was the sensation of being utterly alone in a strange new liquid world. Actually the dangers to a person in good health walking along the ocean bottom of the Dry Tortugas at a depth of 15 feet are slight. If the air supply should fail, one could easily remove the helmet, jump to the surface, and swim to the waiting boat.

I soon got into the swing of the game. The air came rhythmically in time with the see-saw action of the hand pump in the boat. Faintly, as in a poor telephone connection, I could hear the grinding and squeaking of the pump, and the air smelled of old rubber; but soon all these sensations vanished as the vision of a new world opened beneath the sea.

I was dressed as if I were strolling on the beach instead of below its waterline. I had on an old cotton shirt and white duck trousers, and heavy rubber-soled sneakers. These clothes were desirable to avoid scuffing the skin on the living coral formations which, though fluffy-looking, are as rough and effective as spinning grindstones.

My five-foot iron cane, which had been very heavy above water, was now exceedingly light. With it I speared and exposed the soft parts of a sea urchin to attract the fishes in the neighborhood. They flocked to the kill with amazing swiftness—like turkey buzzards to a dead animal. A huge mass of living corals appeared in the foreground, and I approached it with my bobbing gait. Distances under water are deceiving. I reached out my cane several times to touch the corals but each time was surprised to find I was not anywhere near. Eventually, closeup, I saw the community life of a coral homestead,—the tiny stone-building coral animals themselves, the many varieties of marine worms with highly colored tentacle-like feelers, and fishes of many hues. The fishes did not seem to alter their everyday activities in the slightest because of my presence, and for the moment I had the feeling I was seeing all this on a motion picture screen. Each species seemed to have a peculiar rhythmic way of swimming; some glided, some wagged their tails vigorously, some bobbed up and down, and others moved steadily and gracefully as if propelled by invisible fins. Small slippery dicks (*Halichaeres*) approached unconcernedly and in galloping strokes cruised between my legs. Many others passed by me—far too many for me to remember at the moment when the scene was constantly changing and veiled in a film of unreality.

Suddenly an old terrestrial sensation returned to me, and I felt that someone was watching me from behind. I turned around as quickly as I could, and there—about twenty feet away and floating high over my head like a personified fishy dirigible—was a huge barracuda. It was pointed in my direction, and I could feel its evil eye upon me. Remember, this was my first trip down. What would you have done? That's right! I got out of there just as fast as I could. I followed that black rubber hose as though it were a white line on a foggy mountain road. When I saw the belly of the boat 15 feet overhead, I crouched and leaped for the dangling ladder. In my excitement I became befuddled and misjudged the distance. I finally made it. Dr. Longley and his assistants knew what was up and were laughing.

"He wouldn't hurt you," the director said. "Why, I've been going down in these waters for 20 years, and a barracuda hasn't nipped me yet. All you have to do is point your cane at them if they get too inquisitive."

I nodded, saying, "I'll remember the next time I go down"; and I did.

Much later I saw a movie of underwater life, and it seemed that my experiences were re-enacted, except for the behavior of the barracuda and the cameraman. After some fine shots of the colorful coral community, showing sea fans, gorgonians, and the tropical jewel fishes, a huge barracuda was seen in the background. It came closer and closer to the camera's lens until it filled the entire field, yet the photographer stood his ground. I have never heard of a barracuda injuring a diver and this seems to be in keeping with the habit of the fish to strike at moving, splashing objects at or near the surface.

The ferocity of the West Indian tiger-of-the-sea was vividly described by the early French and English explorers to the New World, but they also ascribed to the barracuda powers which it does not possess. In 1665 the Sieur de Rochefort claimed that the fish's "teeth have so much venom that its smallest bite becomes mortal if one does not have recourse at that very instant to some powerful remedy in order to abate and turn aside the force of this poison." Actually, any toxic quality that the barracuda possesses may be caused by putrefaction after its death. And Sir Hans Sloan asserted in 1707 that the barracuda "feeds on Blacks, Dogs and Horses, rather than on White men when it comes at them in the water," implying erroneously that the fish discriminates between men and beasts, and man and man. The French historian, R. P. Labat said in 1742 that it is common knowledge, or as he quaintly put it "public notoriety that these same fish more often attack an Englishman than a Frenchman." He explained this fantastic notion by suggesting naively, that the Frenchman is a more delicate person, while the rugged Englishman, being a heartier meat-eater, produces "an exhalation of corpuscles whose odor is more penetrating, which scatter farther, and which strike more upon the organs of these animals." This, of course, is a statement based on prejudice rather than on fact, and J. R. Norman, late fishery expert of the British Museum of Natural History was right when he pooh-poohed these biased notions as nationalistic propaganda.

The barracuda is innocent of many of the early historians' charges. Modern naturalists know and respect the barracuda's true powers; they say to you: "Whoever you are, do not go swimming with the barracuda."

BELINDA & CO.

The Lesser Bush Babies

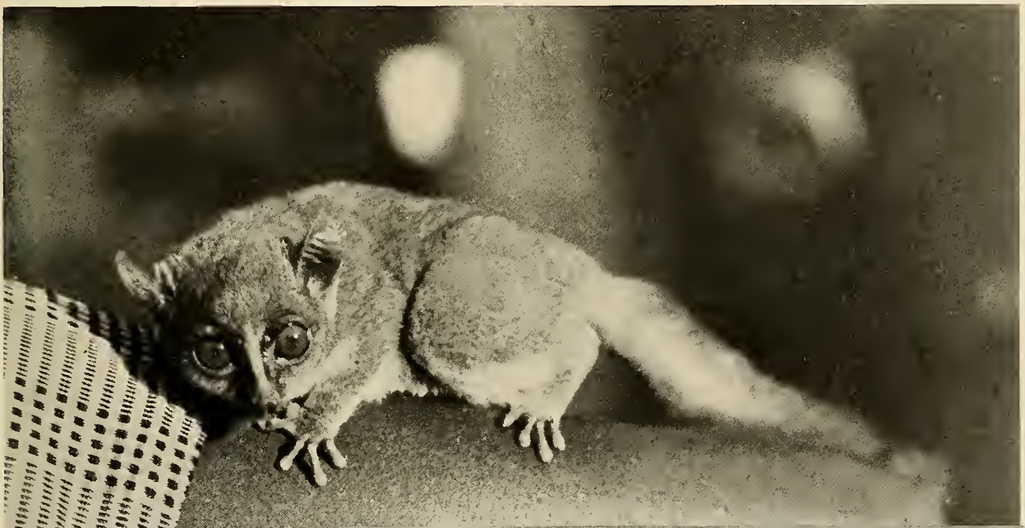
Photographs by the author

Tiny cousins of the monkeys provide companionship at a Forest Station on the Gold Coast

By G. S. Cansdale

Gold Coast Forest Service

We had almost given up hope of getting a lesser bush baby when Belinda arrived from a Forest Station about 100 miles away. She had been caught in the thick bush and brought in to a colleague of mine by a member of his field staff. It was explained that she had escaped during the night and had later been discovered up under the eaves of the house. She had been persuaded to drop into a tarpaulin spread below, and then had had this journey of about 100 miles by lorry and train to Accra, the capital of the Gold Coast, where we were stationed. She looked rather pathetic and frightened when she arrived but cheered up at the sight of some grasshoppers and moths, taking and eating all she was offered.



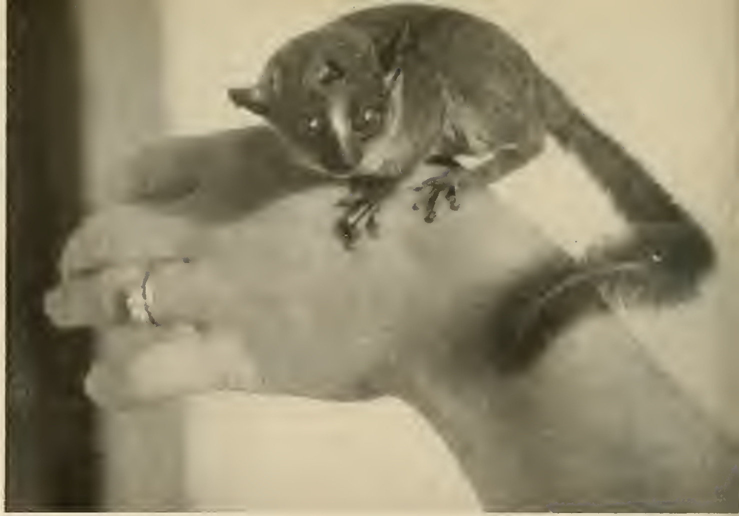
▲ Kobina, perhaps the tamest and most friendly of the bush baby pets, was brought in as a tiny youngster and reared by hand

➤ Typical "high forest" of Eastern Ashanti, from which Kobina came. The District Commissioner's house can be seen in the foreground. A Forest Reserve, covering the distant hill, is the home of the bongo and the giant forest hog

A roomy cage, some 5 feet by 4 feet by 3 feet, with a sleeping box and plenty of long perches, was soon ready. As we put her in it, we saw how lucky we were, for she was very obviously an expectant mother. The larger species of bush baby, sometimes called the Moholi galago, has often been observed in captivity and has bred there. In fact, it is kept as a pet in England as well as in East and South Africa. But we could find out nothing about the smaller kind. (I later learned that the London Zoo had once had the species but found it very difficult to keep.) It was obvious from the literature, however, that galago mothers are temperamental and apt to eat their young if disturbed, so we took great pains to persuade Belinda to settle down. She did so very quickly and within ten days was jumping onto the hand, inside her cage, to take insects.

This was not quite my first experience with this delightful little creature, for I knew it well as a common inhabitant of the tropical forest whose call was to be heard all and every night during my frequent periods in camp. In 1938 a tiny youngster had been brought to me and successfully reared on powdered milk and biscuit crumbs soaked in it. I called him Kobina, the Ashanti name for a boy born on Tuesday, the day he arrived. He grew up to be a most charming pet, but when he was about six months old my work changed and I had such a roving existence that I passed him on to some friends who were very glad to have him. My wife had been promised that when she joined me in West Africa she should have one; but this proved a difficult promise to keep, for although these tiny lemurs are common and are found over a large area, they are very hard to catch. So Belinda was indeed welcome.

The pictures give a fair idea of the size and appearance of this animal, which is small enough to curl up easily in the hand. The head and body of an adult are about four inches long, and the tail six or seven. Bush babies are lemurs and, being Primates, belong in the same natural order as the apes and monkeys. The lesser, or Demidoff's, bush baby is among the very smallest of the order. The enormous eyes are perhaps its most marked feature. The iris is pale brown, and when at night the round pupils dilate until the irises almost disappear, the eyes reflect light brilliantly with an orange-yellow glow. The animal can turn its large, sensitive ears through a wide angle and can fold them right back. Hands and feet both have well developed digits with tiny nails, except for the second digit on the foot, which has a claw. The bush baby can grip strongly with the whole hand or foot but has no individual control over the digits. Belinda was of the dark color variety. Her head and body were mainly a mousy gray-brown, almost fawn beneath. A whitish stripe ran down the nose, and the tail had a rather darker tinge.



▲ Jacko, about three months old and very nearly full-grown. The lesser bush baby is small enough to curl up easily in the hand

Belinda was offered a variety of leaves and grass for bedding, all of which she ignored. Then one morning after she had been with us just a fortnight we found she had given birth to a single male on the bare wooden floor of her sleeping box. Its eyes were wide open, and its head seemed even bigger in proportion than its mother's. It was able to move freely and when only 24 hours old ran at least two feet across the box, to the consternation of Belinda, who was always very jealous for its safety. Her method of carrying it was very interesting. She would pick it up in her mouth with a firm grip around the middle of the body so that it hung level, not by the skin of the neck as cats and dogs do. She could freely jump two or three feet while carrying the youngster, and this went on until it was about half grown. Then it began to resist her efforts, and she gave up. In the first few weeks we had to approach the cage quietly, for at the least alarm she would pick it up and run around with it.

Most accounts of the breeding habits of the *larger* kind say that one or two may make up a litter. They mention also that the young travel clinging to the upper or underside of their mother. (I have since learned from a keeper at the London Zoo that the mother also carries the baby in the mouth as just described.) But Belinda's infant seemed quite unable to cling to her. It often sat on her while at rest but fell off when she moved, so we wondered whether the smaller kind ever had twins and, if so, just how they would be carried around. This is really getting ahead of our story, but Belinda was good enough to have twins for her third litter, and we were able to note that while she carried one in her mouth, the other, at a day old, could cling to the root of her tail and be carried along. Far from being allowed to help, the father was plainly told to get out; in fact, she dragged him to the opposite end of the box by the scruff of his neck.

Jacko, the first youngster, grew up to be quite tame, though he definitely preferred the safety and seclusion of his large cage for the most part. At breakfast he would come out and sit or sleep contentedly under my wife's table napkin or in my pocket, but at the least alarm or disturbance he would make his way back home.

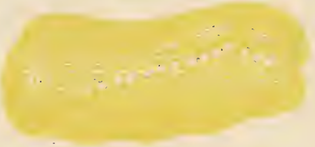
When Jacko was a few months old, another adult was brought in, a male of the pale color variety, whom we called Blondin. He was of a light straw color generally, very pale beneath, and like the others, he had a rather darker tail and a whitish stripe down his pointed nose. By this time Jacko had been weaned, so he was put in a cage by himself, while Blondin shared a large cage with Belinda. We never saw Blondin take any interest in Belinda, but in due time she became the mother of Bimbo, a female intermediate in color between the dark and light parents. Later on, as already described, she had twins, but unfortunately I came away on leave when they were only a few days old, so I cannot report on their later development and behavior.

▲ **Walking** along a stick upside down, Jacko shows something of his ability to turn his head 180° in either direction

The lesser bush baby—*galago demidovii demidovii* Fischer, to give it its full scientific name—is found in the forests of West Africa from Senegal down to the Niger. Other races of *demidovii* are found in the Cameroons and the Congo and even as far away as the Tanganyika Highlands. It is an animal of the high, or closed, forest and not of the open savanna forest (orchard bush or parkland) found over such large areas of Africa, which is the home of the larger kind, *Galago senegalensis* and its many subspecies. In my experience the lesser bush baby keeps mostly to the smaller trees and shrubs rather than to the higher trees. As the size of the eyes suggests, it is normally nocturnal, but I have very occasionally seen one on the move in the forest during the day.

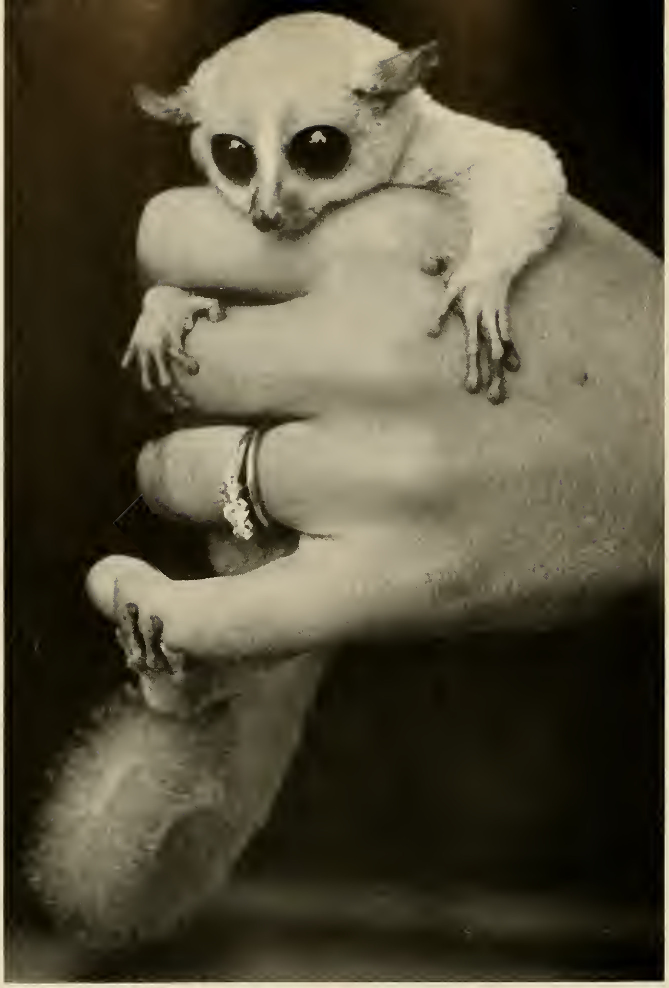
▼ **On the alert** in the garden. Jacko, with his ears fully spread and forward

Its call is one of the most familiar night sounds in the tropical forest, a chatter surprisingly loud for the small size of the animal and having a definite tonal pattern. It starts softly and slowly and then quickly rises in pitch, volume, and tempo, roughly as shown in this diagram:



The call lasts for about four seconds, and it is normally repeated once after an interval of five to ten seconds. When we had two adult males in cages some distance apart, one would always answer the other's call, and the round would finish with a reply from the first.

Several other quite distinct calls were also made. The loudest was a very definite alarm note, a continuous high-pitched *kek - kek - kek - kek,* which went on while the danger was present and sometimes for long after. This signal was normally reserved for cats, dogs, and snakes, and it was



▲**BLONDIN**, a male of the pale color variety. He was the shy one and would never pose for a picture

so definite and genuine that my wife or I always went out to the veranda, where they had their cages, to see what the trouble was. Once I had some small Royal Pythons ready to be shipped to England. Somebody was careless in closing the box, and one escaped. It was given up as lost, but some nights later the bush babies protested very loudly when it crawled across the garden in the brilliant moonlight, and I was able to catch it.

Another alarm was milder and was sometimes made without obvious cause, a single note *chk* followed by a soft voiced *oooo*. Jacko sometimes made this *oooo* by itself, though it did not seem to have any definite significance. Then the youngster had his call for help, a plaintive, rather shrill, *sreet, sreet,* at which Belinda would at once come out, pick him up, and carry him home. As she approached she made a very soft answering chatter, almost a purr, and Jacko sometimes made the same sort of note as he returned to the others in the cage after he had been out for a spell.

Perhaps their most astonishing attribute is their agility. The elongated ankles and wrists give bush babies, in effect, an extra principal segment to each limb, and they thus have an amazing ability to jump and cling. Jacko's hind legs measured a full five inches, and at times he sat with them stretched out straight in front of him, in a position sometimes favored by chimps in captivity. During the day, unless they are alarmed, they are rather sleepy and move in a leisurely way, but for most of the night they are like quicksilver. An adult can easily manage a horizontal standing jump of six feet, and even youngsters of two or three weeks can manage two feet. Before taking a long jump they seem almost to take the range by moving the head up and down once or twice. They are very accurate, only falling if the landing place fails to give the expected hold. In one of the pictures Jacko has a small bare patch on his head; this was first thought to be the result of a fall but was actually caused by his taking a long jump near the top of the cage and hitting the roof because he had not taken the trajectory into account. The hair soon grew again.

Their zeal for jumping makes photography difficult. This was especially true with Jacko, who would try to jump onto the camera as it came within range, even if it meant taking off from a difficult angle and turning in the air to land facing the other way. The neck is very flexible and allows the head to turn through a full 180° each way. Bush babies, especially young ones, utilize this ability liberally, turning the head first one way and then the other to inspect some novelty.

When waking up in the early evening they enjoy stretching themselves luxuriously along the perches, putting one foreleg and then the other right out in front, then extending the hind legs straight out behind. Jacko and Bimbo also held out their legs like this to be tickled. They very occasionally hang vertically, head downward, to stretch. This is a regular exercise of their larger cousins, who hang in this position for minutes at a time. The two varieties differ materially in their movements on the ground. *Demidovii* is an inhabitant of the dense forest, where the ground is covered with several layers of trees and shrubs which it need never leave. In captivity, one occasionally came to the ground, though it never seemed happy there, and when it did, it moved on all fours, rather as it would on a horizontal branch. *Senegalensis,* on the other hand, holds itself upright on the ground, with the forelegs bunched up in front, and moves in great leaps of as much as ten feet, somewhat like a kangaroo. This method of movement is obviously one often used for getting from tree to tree in the open savanna forest, where the trees are generally well separated. Its general position at all times, for feeding, resting, and so on, is much more upright than that of the lesser bush baby.

People often do not realize that many of the smaller mammals are very fond of insects and that quite the most popular thing to take on a visit to the zoo is a box of meal worms, grasshoppers, or stick insects. In West Africa there are two small genera, the dormice and the bush babies, each with two species in the Gold Coast, which are largely carnivorous, though most of their relatives are mainly vegetarians. Both kinds also take other foods, but it is most probable that their staple food is insects, together with eggs, small birds, and animals. In captivity the lesser bush baby will eat a large variety of insects, and our tame ones were given enough to form an appreciable part of their diet.

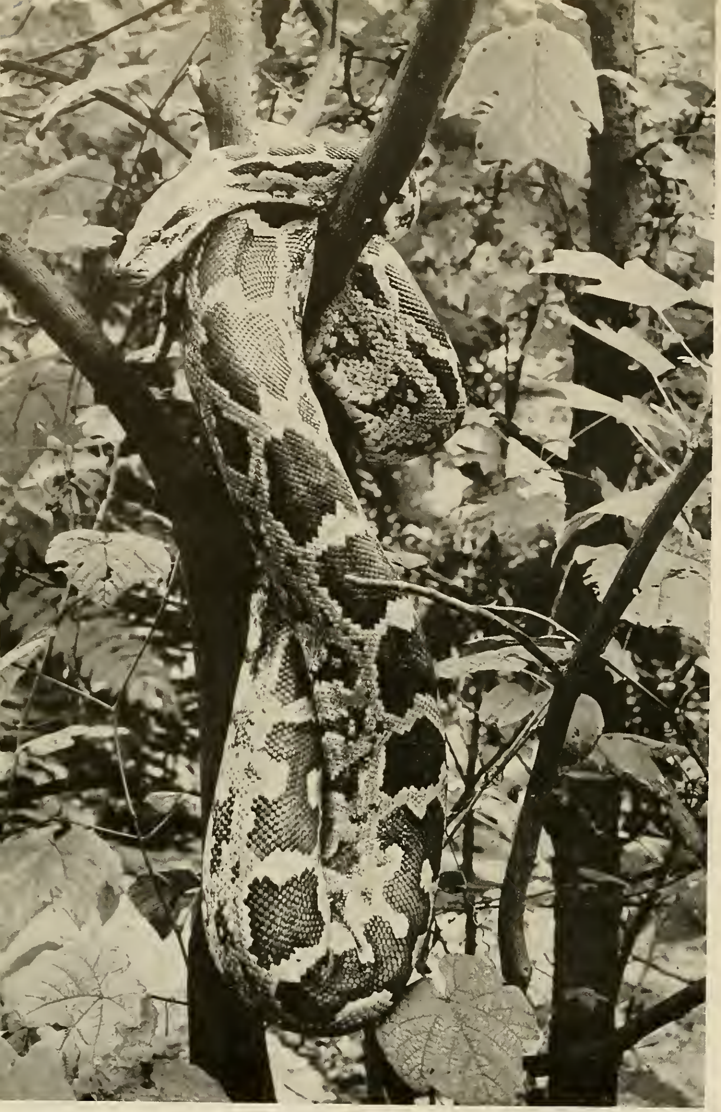
For some time they were fed mostly on the giant cricket, collected by the garden boy in crop defense. This insect is nearly two inches long and as fat as one's forefinger, with hefty back legs and powerful mandibles that could almost sever a bush baby's leg, but Belinda was expert at dealing with one. She would pounce on it suddenly but very carefully with both hands and immediately paralyze it with two or three crushing bites in the head. Then she would pull it to pieces and eat it, joint by joint. The same method was used with all strong and hard-bodied insects such as locusts, praying mantids, and beetles. The bush babies were very fond of moths and would get wildly excited if one flew near the cage at night. They ate most kinds regardless of size, but certain kinds, mostly bright-colored ones, were always refused. Although a good mother in some ways, Belinda never offered her young ones any titbits. In fact, until they were big enough to hold their own, she would greedily snatch from them any insects they picked up or were given. They also took such fruit as bananas, avocado pears (of which they were inordinately fond), oranges, and papayas, although none of these would normally be obtainable in their native haunts. They never touched water but drank fruit juice and milk every day. They are very clean creatures and spend a lot of time licking themselves and one another.

Finally I must say something about the very different personalities of our four pets. Belinda was a very bold mother but was always shy and averse to being handled. Jacko was really tame in the daytime and welcomed attention, but at night he could not be touched. For a long time he was very jealous of his half-sister Bimbo, and if he saw her near his cage he would fly into a rage and try to snatch at her through the wire. Later, however, they became great friends. We had several small squirrels living free about the house and garden, and in the evening, before retiring to their sleeping places, two of them liked to go into Jacko's cage to look for titbits. Jacko was rather scared of their boisterous movements and would gaze at them open-mouthed; but if they came too close, he would raise himself up to his full height and bring his hands down hard on them from above his head. The two older bush babies merely ran away from the squirrels, but Bimbo also beat them if they took liberties. She took after her father Blondin and was rather shy, not always wanting to come out of the cage. She was always sensitive, and one had carefully to avoid frightening her. Strangely enough, she was much tamer at night and loved to run up and down an arm put inside the cage. Poor Blondin was just too scared for words when anybody was about, but on his own he could stand up for himself and snatch a grasshopper from any of the others.

➤ **BIMBO**, full-grown. Female bush babies are slightly larger than the males. The long ankle and wrist are plainly seen here, also the pointed nose which is so characteristic of Demidoff's bush baby

▼ **BIMBO**, Jacko's half sister, at about two months, when her coat was very light, with a distinct touch of yellow in it. It darkened a little as she grew up

Adventu



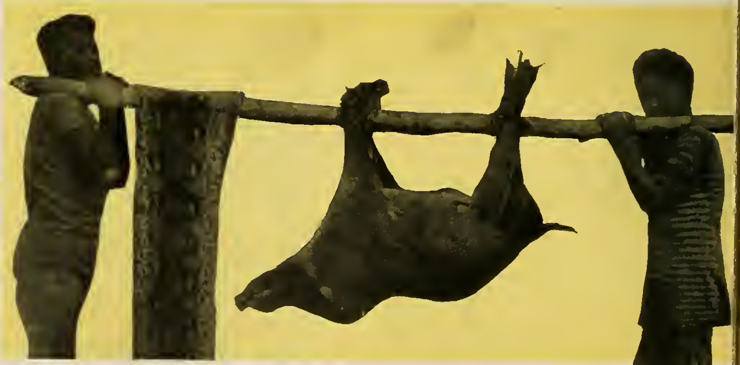
New York Zoological Society photo

▲ A Black-tailed Python of India: a species closely related to the Borneo pythons described here. The small pit near the nostril is one of a pair of heat receptors used to locate warm-blooded prey in the dark. Some pythons have as many as a dozen on each side. This species exceeds 20 feet in length

The largest species of serpent in the world inhabits the East Indies. It is the Regal Python, known to science as *Python reticulatus*, and to the Malays, who share its habitat, as Ular Sawa. Ular is their name for snake, and Sawa means a python.

Pythons ceased to be a mere name to me and assumed a semblance of reality even before I started for the East Indies in 1912. I had the pleasure of meeting a Norwegian explorer, the late Dr. Carl Lumholtz, who was also planning an expedition to Borneo, and in the course of our conversation he told me there would be times when I would have difficulty in obtaining fresh meat for food. At such times, he said, if I could get a python I would find its flesh very good, though best of all, he thought, was the liver. This had been his experience, gained years before, when he had visited the tropical part of North Queensland, Australia. As will be seen later, I found that the Dyaks who inhabit the interior of Borneo make a practice of eating the flesh of the python and appear to like it.

In Borneo I met white men whom I questioned about pythons, but few of them had any first-hand knowledge. One told me that pythons occasionally crawled into his henhouse at night, and after devouring some of his valued fowls, they would be so distended as to be unable to crawl out again between the bars. They would then be discovered and killed in the morning. I also met people who said a python was a good thing to have about the house to keep the rats in check. They of course referred to small or young



➤ Swallowed by a snake: a 125-pound wild boar taken from the digestive tract of a 24-foot python in the Philippine Islands

s in *Python* Country

By Harry C. Raven

Late Associate Curator of Comparative Anatomy,
American Museum of Natural History

In search of the world's largest snakes in the jungles of Borneo

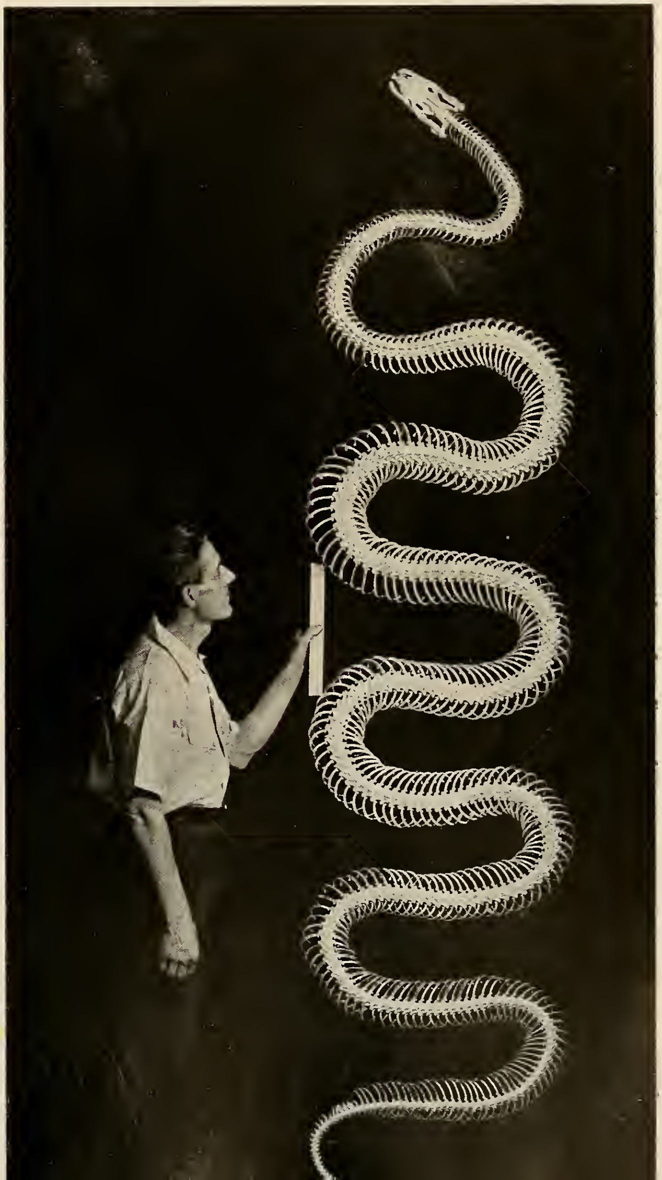
pythons, not over five or ten feet long.

The first python I saw in its native habitat was sunning itself on a horizontal branch of a tree overhanging a river. I was sitting amidships in a dugout canoe at the time. The Malay boy who was sitting in the bow said, "Sawa," reached out with his paddle, and touched the branch, whereupon the python gracefully slid off and disappeared in the dark water.

After shifting about in Borneo, from river to river and from reef to reef, and never getting more than a degree or two north or south of the equator, I crossed the Strait of Macassar in my little schooner and sailed along the north coast of Celebes. Stopping near a mining camp at a place where there was a good harbor, I left the schooner and went inland a short distance to camp on the mountains, which were covered with virgin jungle. The white men at the mine told me of a huge python one of their natives had killed a few days before my arrival, and showed me a very poor photograph of it taken after it had been killed and dragged to camp. Though the print was dull, you could see a man standing on the huge body, which was about a foot thick. The civil engineer told me it was just ten meters (33 feet) long. I asked him if he had paced off its length, but he said, no, he had measured it with a surveying tape. No part of the animal was preserved. It had been rainy weather when it was killed and on account of the dampness not even the skin was kept. I visited the place where the carcass had been cast aside. There was only the odor, and a few little pieces of bone left. Wild pigs, kites, monitors, and maggots were the jungle scavengers that had disposed of it. I greatly regretted not having arrived at this place a little sooner, as I very much wanted a large python and this was the largest one I had heard of.

Much to my surprise, I was told a day or two later that another python of about the same size had been seen not far from the place where the first one had been killed, which was quite

A.M.N.H. photo



The python has more vertebrae than any ther animal, so far as is known. This reticulated ython, 22 feet 9 inches long, had over 400

New York Zoological Society photo

▲ A 20-FOOT example of the kind of python described in this article

near my camp. The mine officials kindly gave orders to the coolies, who were making survey and prospect trails through the jungle, to report to me immediately if they happened to see it again.

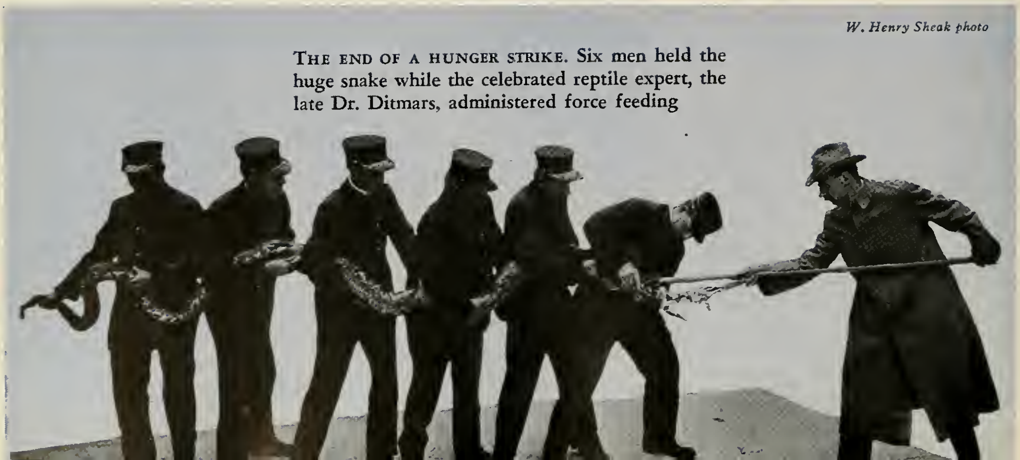
One morning several days later a Javanese coolie, almost breathless, arrived in camp to say he had just seen the great python. I picked up my shotgun and some shells loaded with buckshot and followed him down a little valley beside a stream that flowed through the heavy forest. He hurried along ahead of me for about half a mile, then stopped, and, as he looked at the narrow path, remarked in Malay that the python had gone. I could see the place where the snake had been on the path and told my companion we would follow its trail and kill it. He said that he had to go to work immediately or his boss would be very angry, and besides he was afraid of snakes.

I could not persuade him to stay, so as he went off I began cautiously to follow the trail. I had not gone more than a few yards before I realized that I was really on the trail of a giant. I was amazed at the apparent weight of the animal. Where it had moved sideways and pressed against little bushes they were bent flat, and where it had gone over a piece of dead wood, this was broken and pressed into the ground. Every moment I expected to see the fore part of the huge body rise up with gaping jaws, ready to strike at me, but nevertheless, I followed the trail for about 50 yards between rocks and over roots of trees, through twisted masses of lianas and rattans, where I occasionally had to use my machete.

Then the python had turned toward the stream, scraping the moss off the root of a tree as it had slid into the water. It had gone on downstream, sometimes sliding over rocks where I could easily see its marks, or over sand and gravel that looked as if a huge sack of grain had been dragged over them. Here, because the banks in some places were so high and steep, overgrown with ferns and begonias, and because in others the stream flowed under the bank and the projecting roots of great trees, I could no longer follow the trail and had to return to camp, down on my luck for having missed another giant python.

My friend, Mr. Lingard, of Borneo, a nephew of Conrad's Lord Jim, once told me of an experience he had had with some Punan Dyaks and a python. The Dyaks were serving as Mr. Lingard's paddlers on a trip up one of Borneo's beautiful rivers to the interior. He was reminded of this python incident while warning me against Punans as paddlers, for, said he, they never pay attention to their paddling but are always on the lookout for food of one kind or another. They stop paddling to try to catch fish in a circular throw net, or to gather wild fruit from trees along the bank, or again to see what their dogs, which they have released on the riverbank, hold at bay and are barking at. The dogs might be barking at a porcupine, or some sort of civet hiding in a hole in an old log or under the roots of a tree; they might have treed a wildcat, of which there are many species in Borneo, or a clouded leopard. However, it was more likely to be a wild boar, which they could hold at bay in its muddy wallowing place or between the buttress-like roots of some forest giant. After being worried by some such delays, Mr. Lingard was hoping his paddlers would not see anything more to distract them as they paddled along, a few feet from the bank, when suddenly one of them in the middle of the canoe dropped his paddle, and with an exclamation leaned over the side and grabbed something. It was the tail of a python which had just been sliding off the bank into the water.

In the commotion that followed, the dugout was nearly overturned. The Dyaks kept their heads, how-



W. Henry Sheak photo

THE END OF A HUNGER STRIKE. Six men held the huge snake while the celebrated reptile expert, the late Dr. Ditmars, administered force feeding ever, although all of them, even the one pulling at the serpent's tail, were shouting like maniacs. Several had dropped their paddles and taken out their two-foot, machete-like knives, when out of the water darted the python's head. With a single blow one of them nearly severed it. They then got hold of the great body and made fast to it with rattans. All stopped paddling, and the canoe, tied to the huge, wriggling, bleeding python, drifted downstream. As the natives watched the dead body writhing in the water, they discovered that their victim had recently fed upon some large animal, for they could see the bulge in its sides. It was but a short distance to a bend in the river, where, owing to the low water, a large gravel shoal was exposed. There they encamped for the night and prepared their evening meal. Mr. Lingard said he was disgusted with those Dyaks, for they not only roasted and ate the python, which was about 20 feet in length, but also ate the two half-grown wild pigs they took from its stomach.

About a year and a half after my conversation with Mr. Lingard, which, by the way, took place in his quarters in the rear of a little Chinese shop in northeastern Borneo, I was encamped near some Dyak clearings on the upper Karangan River. Most of the Dyaks had finished planting their season's crop of rice and were preparing to go after wild honey. The preparation consisted of making bark vessels in which to put honeycomb, making torches, or rather smudges, of certain split and dried lianas tied round with rattan, and preparing rice in various ways to take along for food. On honey-gathering expeditions, which are regarded as great festivities, the Dyaks would usually go off in family groups, and camp by a stream or river, half or quarter of a mile from the trees harboring the hives. These magnificent white-barked trees, that usually tower over the rest of the forest, are greatly-prized possessions, each Dyak family having its own particular ones, which are handed down from generation to generation. The men climb up at night and slit open the hives to get the honey and young bees, while the women and childen below make a smudge with bark and the liana fagots. Sometimes there are dozens of hives in one enormous tree. The Dyaks may work at getting the honey all night, having, of course, to be very careful in climbing about in the dark. The children wait below and scramble for any pieces of honeycomb they hear drop, and all in all they have a very good time. At the approach of dawn they hurry away to their camp to avoid being attacked by the bees they have robbed.

During the day, on these excursions, the Dyaks sleep and lie about on their rattan mats, talking and eating honey and larval bees, which are delicious either raw or cooked with honey. They have other food too, such as nice nut-flavored rice, sweet potatoes, bananas, and various fruits from the jungle. On a picnic of this kind they are more apt to have meat than at any other time, for some of the men and boys are sure to tire of lying about the camp and wander off to hunt wild pigs and sambar deer.

It was while hunting pigs one day, that a Dyak boy I knew had a very narrow escape from a python. His dogs, which had been in hot pursuit of a wild boar, had at last apparently got it at bay, and he ran through the forest in the direction from which the barking came. In so doing he naturally followed the trails made by wild pigs, beside which the pythons await their prey. As he ran down a little gully a python struck at him. Fortunately he was crouching low, so it did not get hold with its teeth but hit him with its neck. The boy was bowled over but scrambled on and escaped. He returned to camp so severely frightened that he had fever for several days afterward. The fever was malaria, which manifests itself in most of the Malays and Dyaks of this part of Borneo, though only when their bodies are weakened in some way, as by fatigue or injury. In this case it was mental shock. At first he would not go into the jungle at all and for several days moped about the clearings, spending most of his time in his parents' hut. Later I saw him gathering rattans in company with some of the men of the village. This seemed to me to be a stage in his recovery; he would go into the jungle but not alone. At about this time I moved on to another camp, and did not see the boy again. It is probably such experiences as this youth had, or the association with people who have been subjected to such experiences, that tend to make the Dyaks and Malays, who live in the jungles, always go armed.

I have never definitely known of a person being killed by a python. Of course the Malays tell many stories of people who have been eaten by pythons, and there is no reason to believe a large python could not swallow a small man, such as a Malay. The second year I was in Borneo, I had with me a very good Banjerese Malay, who had lived on the east coast of Borneo for a number of years. He had frequently been on excursions into the jungle to gather rattan. On one of these excursions, he told me, he, and three or four companions, spent several weeks gathering rattans in one locality. They had only the one camp during their whole stay, but they wandered to a distance of a mile or more in every direction; consequently they knew the country well, especially as this was not their first visit to the place. Finally they finished gathering rattan and prepared to return home to their kampong. On the morning they were to start for home, one of them remembered that he had one more bundle of rattan to bring down to the boat. Therefore he told the others to put everything aboard, while he went for it. They made ready to depart, but the man who had gone for his rattan did not come. They called, but he did not answer. After waiting a little while, one of them went to look for him. The searcher brought the bundle of rattan and said there were no signs of their companion having been to it. They then thought he might perhaps have been taken sick and gone back to the camp site. He was not there, and they called and hunted throughout the day until late afternoon. The lost man knew the country better than any of the others. He had been hunting over it every day for weeks. It was impossible to believe he had simply lost his way in going half a mile over country he knew so well. If he had had occasion to go near the river, they would have supposed him caught by a crocodile, but there had been no such occasion. Toward sunset they paddled down to the coast where they met some "Orang Laut" or seafaring Malays. With them, they returned the following day and searched but found not the slightest clew as to what had become of their companion. They concluded he had been caught by a "hantu" (ghost), or "Sawa" (python). That is the secret of the jungle and, "*Allah sadja yeng tahu*" (God only knows).

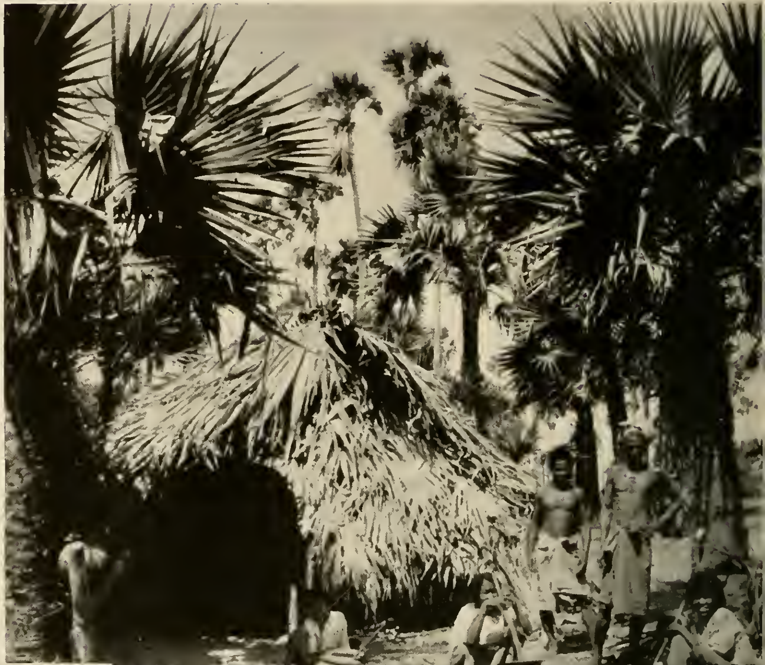
Desert Sweetness

How the Burmans solve the sugar problem—with sugar made from toddy palms that resembles maple sugar

By BARNUM BROWN
Curator Emeritus of Fossil Reptiles, American Museum of Notural History

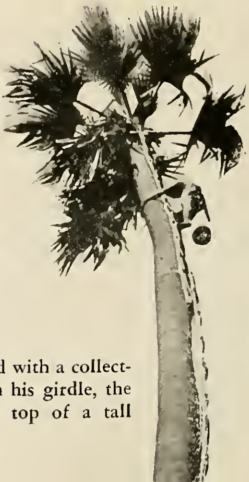
THE sugar of commerce is the crystallized juice of sugar cane or sugar beets grown chiefly in the West Indies, United States, East Indies, and Central Europe.

During these days of post-war shortages of foods essential to the health and welfare of communities, with consequent rationing of supplies, there is one area of large size that supplies its own sugar needs in an interesting and unusual manner, besides producing considerable sugar for export.



▲ TEMPORARY HOME of the sugar workers. Palm trees not only provide sugar, but also building materials for their huts

◀ THE SAP GATHERER makes his morning rounds. He is followed by his wife, who carries away the sap in chatties suspended from the ends of a pole carried across her shoulder



➤ BAREFOOTED, and with a collecting jar slung from his girdle, the climber nears the top of a tall palm tree

➤ COMING DOWN with a load of jaggery, the gatherer leans out with two heavy jars suspended from his waist

In the semiarid sections of upper Burma, along the tributaries of the Irrawaddy River, there are groves and scattered groups of palms, sometimes filling small valleys and extending far up the rolling hillsides. They are the toddy palms (*Caryota urens*) which in general appearance resemble the palmettos of Florida, although taller, some reaching a height of 80 or 100 feet.

During several months, until the beginning of the rainy season, the Burmans make sugar from these trees. Most of the native families use it in preference to imported cane sugar, and in peace times export a million dollars worth annually to India. In quality and flavor it closely resembles our American maple sugar.

Sap is taken only from the female trees, which are not allowed to bear their miniature coconut-like fruit during the sugar season, the dry period from January to April. To accomplish this the flower stalks of near-by male trees are cut off or tied up, so that their pollen cannot be dispersed. Then the flower stalks, usually two or three clusters on each of the female trees, are carefully tied in long rolls so that they cannot open, and the end is cut off, allowing the sap that would normally form nuts to trickle out drop by drop. An earthen jar is suspended under each flower stalk to catch the drip. Finally a bamboo ladder, beginning about 20 feet from the ground and reaching to the flower stalks, is firmly secured to the tree.

photos by Mrs. Barnum Brown

The fresh juice is mildly sweetish and rather insipid, but if allowed to stand six or eight hours its character changes rapidly. When fermentation begins, the flavor changes from hour to hour, and at some stages it is a delicious beverage. The Burmese are very fond of the fermented toddy juice, which is a mild intoxicant.

The sap gatherer visits each tree morning and evening, carrying a light movable ladder 20 feet in length, which reaches to the permanent ladder. Naked, save for a loincloth, he climbs sometimes to 100 feet on this frail affair, with a large sheath knife at his side and one or two collecting jars slung from his girdle. The drip jars are emptied into these, and a thin slice is cut from the end of the flower stalk at each visit, so that it bleeds freely when the drip jars are again tied in place. It looks simple to watch a nimble, barefooted Burman climb one of these tall trees swaying in the wind, but when I essayed the climb I soon found that shoes were not suitable for the ladders and my courage ebbed on a tall tree.

Someone follows the climber through the grove, usually with two large earthen chatties suspended from the ends of a pole carried across the shoulder, in which the jaggery, or sap, is carried to the boiling place.

If the grove is large, a palm-leaf hut is made with a long trench running down the center where the sap is boiled down over a slow fire. Five or six large earthen pots stand over the trench, and the new sap is poured into the pot at the upper end. Usually an old experienced woman attends to the boiling, and at intervals she dips the sap from one jar to another until it is finally boiled down to the point of crystallization over the hottest part of the fire. At this time the sap is dipped into another receptacle and allowed to cool, whereupon it is molded by hand into small round balls.

Under the most favorable conditions two gallons of sap will produce a pound of sugar, the quantity depending chiefly upon the skill of the person who makes it. The sugar made during the first part of the season is always better than that made immediately before the rains, and at best it is equal to maple sugar.

YOUR NEW BOOKS

Continued from page 7

ROCKS AND RIVERS OF AMERICA

- - - - - - - - by Ellis W. Shuler

The Jaques Cattell Press, $4.00
300 pages, 105 illustrations

IN its essentials this book is an introduction to the geologic subscience of geomorphology. In a sense, therefore, the title is misleading, for while the principle illustrations are taken from the American scene, and the origin of certain notable landscape areas is briefly explained, the emphasis of the work is upon the geologic processes involved, not upon the individual histories of our rocks and rivers.

Nevertheless the book contains a vast amount of information on the origin of the landscape. In fact, as one reads it he is apt to feel that there is an effort to impart too much information within the confines of a book of this size. Too many important processes have had to be dismissed with a single sentence or paragraph, with the result that the explanations are at times too sketchy to be at all adequate, or even truly explanatory. To this reviewer at least, it would have been better to have deleted certain extraneous materials, such as the two paragraphs on gem minerals, the appendix chapters on "The Landscape in Art," and "Photographing the Landscape," and similar elements relatively unimportant to the story before us. The author could have used the pages thus gained for a more complete explanation of fundamental principles.

It must not be concluded, however, that this book does not have a place in the growing list of works designed to present the story of geology in terms intelligible to the lay reader. There has been a great need for a work that will make available to the average observer the enthralling story the geologist reads in the landscapes that grace our countryside. This book is a contribution toward that goal, but to this reviewer at least, it does not succeed in fully attaining it.

H. E. VOKES.

THE IROQUOIS

- - - by Frank Gouldsmith Speck

Cranbrook Institute of Science, $1.00
94 pages, 60 illustrations

A NON-TECHNICAL discussion of the Iroquois Indians, their social and economic organization, mode of life, arts and crafts, and ceremonial properties.

VOLCANOES DECLARE WAR

- - - - - - - - - by T. A. Jaggar

Paradise of the Pacific, $3.75
166 pages, 182 maps and illustrations

THE dearth of recent volcano literature makes a new book by the country's leading vulcanologist a welcome addition. Dr. Jaggar begins with some of

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By GESSNER G. HAWLEY, *Chief Technical Editor, Reinhold Publishing Corp.*

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By H. A. MUSHAM

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the latest Hawaiian developments and then recounts his own experiences and those of others at various volcanoes of the Pacific.

His discussion of American volcanoes points out far more clearly than any other book the potentialities of the volcanoes of our Cascade Range, usually classified as dead by the same careless speakers who call Mt. Lassen a live volcano. Dr. Jaggar's classification of these as more recently and less recently active is far more accurate. The description of the Mexican and Central American volcanoes completes the geographical wanderings, but the inaccuracy in the Paricutin account, compiled from hearsay information, leaves one uneasy regarding other accounts not based on the author's own observations.

The concluding section is an interesting discussion of the latest volcano theories, with various authorities quoted at length. The author's years in Hawaii make him prone to think largely in terms of volcanoes drowned in sea water. While the sea may supply chlorine to the volcanoes he has studied, it is hard to accept an abundance of sea water hundreds of miles inland at Parícutin, where ammonium chloride is the principle accompaniment of the abundant water vapor. His wonder at the failure of those who have studied Paricutin to mention sulphurous fumes is countered by our wonder whether the term, as he applies it, is not more often a loose layman's name for any acrid, obnoxious fumes.

The book is essential to anyone who wants to know the latest in vulcanology, but its popular title and appearance might indicate a volume more for the layman than it is. The sentences at times are long and complex. The bibliography is not extensive and does not even include all the author's own works quoted. The illustrations are good, and include a striking daylight color photograph of incandescent lava fountains in Mauna Loa that is the most spectacular volcano picture we have seen.

F. H. POUGH.

TREES, SHRUBS, AND VINES FOR THE NORTHEASTERN UNITED STATES

- - - - - - - - by George Graves

Oxford University Press, $3.00
267 pages

THIS attractive, well-organized book is a useful standard reference for anyone who is faced with the decision of what to plant and how to care for it. The plant lover with an undeveloped property to landscape or with a home surrounded by vegetation selected at random, will find this volume a very helpful guide to the better varieties.

Some twenty years ago this reviewer planted his bare suburban property with shrubs bought by the bundle from a local nurseryman. The varieties were recommended as cheap and rapid growers. They lived up to that recommendation, but ever since there has been a continual campaign of digging up these nondescripts to replace them with better varieties discovered through experience. The reader of this present book can eliminate such years of trial and error.

Most of the volume deals with an alphabetical arrangement of plant genera and their most significant species and varieties. The outstanding characteristics of each are given, covering habit of growth, tolerance of shade, nature of foliage, color of flower, attractiveness to birds, place to be planted, and so forth. Most of the information the average person needs to make a selection can be found in these paragraphs. However, one important item is omitted, namely, whether the plant prefers an acid, neutral, or alkaline soil, a factor of very considerable importance in the case of some groups.

The work is well illustrated with good half-tones which give the reader an excellent idea of the species concerned. There are tabular lists of the trees, shrubs, and vines, and the book concludes with a chapter on how to shop for them. The author warns against too implicit faith in catalogue descriptions, remarking that "the author of a catalogue is human . . ." How true that is. But the gullibility of the catalogue user rises with the sap each spring, and this is part of the fun of the game.

H. E. ANTHONY.

SPIN A SILVER DOLLAR

- - - - - - - by Alberta Hannum

The Viking Press, $3.75
173 pages, 12 color illustrations

THE author's friends, a young couple from the East, took over a trading post at Wide Ruins in the Navajo Indian Reservation in northern Arizona, and managed it for four years. One of their first acquaintances was Beatien Yazz, a shy and silent Navajo boy of eight, whom they found scratching a picture on a rock, using a pointed stone for a stylus. The book is the story of Sally and Bill Lippincott's four-year-long adventure with the Indians around the trading post. The central thread that holds the narrative together is the life and development of the young native artist, nicknamed "Little No Shirt." The book is illustrated with a dozen full-page paintings in color by the boy, who has surprising native ability.

The author's first writing about these people was a recent article in *Collier's*, entitled "Little No Shirt." In the book this story is developed further, and much more of the life of the Indians is included. The Navajo's methods of trading are delightfully described; an outstanding trait is that he cannot be hurried or pressed into buying or selling. A particularly interesting chapter is the one concerning a *Sing* or ceremony to cure snake-bite. There is a good understanding of Indian psychology throughout the book, and the author has unusual facility in writing.

A piece of writing closely akin to this was the author's chapter on "The Mountain People" in Roderick Peattie's recent anthology, *The Great Smokies and the Blue Ridge.*

Spin A Silver Dollar is a moving story well told. It brings to the reader the feel and the spell of the desert country, and the aromatic smell of the sage brush creeps in.

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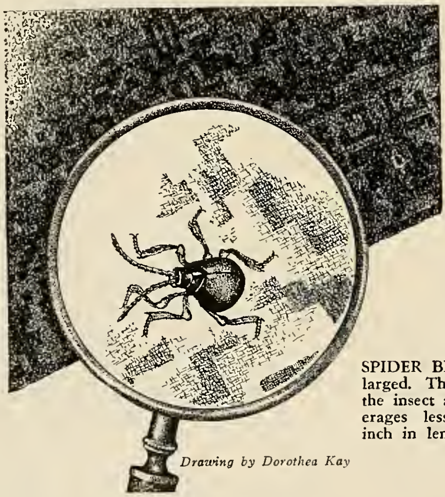
Insects in the House

SPIDER BEETLES

By C. H. CURRAN

Associate Curator, Department of Insects and Spiders, American Museum of Natural History

SPIDER BEETLES, particularly those that are smooth and polished, are the most curious of all the insects to be found in the house. The beetle collector knows them as *Gibbium psylloides.* They are often termed "bathtub beetles," because it is in the bathtub that they are most commonly seen. The insects derive their common name from the fact that they look very much like small spiders as they crawl about. They also have the habit—when disturbed—of folding their legs close to the body and feigning death, just as many spiders do. They are wingless, and the wing covers are firmly joined together so that the upper surface of the beetle is quite smooth, thus adding to their spider-like appearance.



SPIDER BEETLE, enlarged. The body of the insect actually averages less than ⅛ inch in length.

Drawing by Dorothea Kay

We are often asked why these beetles are seen in bathrooms. The answer is that they are most easily noticed when crawling on a white surface. The reason they seem to prefer the bathtub is that they are unable to crawl up the smooth sides if they are so unfortunate as to fall into it.

Actually these beetles are much more common in homes than their rather rare appearance might indicate. Their exact food is not known, but they are to be found in the dust and lint that collects at the edges of rugs and carpets. It is doubtful that they do much if any damage under these conditions, but there are times when they may be a real pest. Very rarely they occur in large numbers on seaweed used for insulation, and they will attack a variety of foodstuffs, such as baby foods, certain kinds of meal, and dog biscuits. Closely related species of the genus *Ptinus* may sometimes be found on similar foodstuffs, and one is a serious pest in flour mills in the Midwest.

The larvae are easily recognized when found in foodstuffs. They look like hairy little white grubs, and the fact that they are curved, with tail and head in close proximity, will serve to distinguish them from other insect larvae found in food or carpets.

As a general rule there is no need for control measures. However, when these insects are abundant in carpets or other fabrics, a soaking spray with any good fly spray will take care of them. Treatment in wall insulation is the work of a specialist. When they occur in foodstuffs, they may be destroyed (and prevented from spreading to other materials) by placing the material in the oven and heating it to 175° or higher.

LETTERS

Continued from page 1

and we soon had from two or three to a dozen of these animals occupying strategic positions about the tile floor. Woe to any luckless insect which crawled too near! It simply vanished, and I was hardly able to detect any motion of the toad.

The beetles seemed to be regarded as choice tidbits, but—and this is the point to my story—I never saw a toad take a motionless beetle. The beetles did not seem to be equipped with radar, and at short intervals one would strike the side of the house with a bullet-like impact and fall to the floor as though stunned. So long as it remained motionless the toad ignored it, but let the beetle roll over onto his feet and start to crawl, and he was snapped up instanter.

One evening the Plant Superintendent brought out a ping-pong ball and bounced it on the tile floor. It bounced or rolled within reach of a toad, and he endeavored to grasp it. It was too large for his mouth, and he succeeding only in giving it an additional impulse so that it rolled in front of another toad, which in turn tried to pick it up. In a short time we had a fair imitation of a soccer football game. This performance was repeated on many subsequent evenings. If the ball was motionless no toad would pay any attention to it.

One evening in the dusk one of the men succeeded in striking a flying bat, which fell to the floor apparently dead. A toad sitting near by ignored it. But the bat was only stunned and presently began to move. Instantly the toad grabbed it,

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and we could hear its dying squeals. I don't think the toad ate any part of the bat, for he left the carcass on our verandah floor.

I do not know the species to which these toads belong nor can I give a description that would mean anything. They are far larger than any similar animal I have ever seen in a temperate climate, but I should not care to hazard a guess as to dimensions or weight. The Brazilian name is "sapo," which is about as inclusive as the English word "toad."

CHARLES W. COMSTOCK.
Jackson Heights, L. I., New York.

* * *

SIRS:

We had a most unusual and very beautiful Armistice Day visitor—a completely white bird. It was not as large as a robin or wood thrush but somewhat similar in build, with a chunky body and longish tail. It was very active as it scratched and pecked at the seeds of crabgrass in the lawn quite near the house. Working with a flock of English sparrows, it paid no attention to them or they to it. "Albino," I thought at first, but its eyes were like little black beads. It was very sleek, snowy white, and without a single dark feather. . . .

Have you any idea what it could have been?

(MRS.) JOHN M. COLE.
New Rochelle, N. Y.

The following comments are offered by Dr. John T. Zimmer, Curator of the Department of Birds, the American Museum of Natural History:

The bird observed by Mrs. Cole was probably a Fox Sparrow and, in spite of its dark eyes, an albino. In one type of albinism the eyes as well as the bill and feet have their normal color. Since the Fox Sparrow's bill and feet are not very dark normally, their lack of any change in color could easily have escaped notice.

It has been asserted that the white plumage assumed in winter by certain birds, like the ptarmigans, is a form of the same sort of albinism shown by the present Fox Sparrow. This probably is correct. In complete albinism the bill, feet and eyes, as well as other parts of the skin and its derivative structures are without pigmentation. The eyes, however, may appear pink owing to the red of the blood showing through the translucent layers; and *structural* color as distinct from pigmentation, may be visible.

In feathers these structural colors are of two special kinds. Microscopic air tubes in certain cells underlining the surface give a characteristic blue color which, in combination with certain pigments, results in violet, purple, or green. A system of thin, transparent plates that reflect interfering light rays from more than one surface (as in a soap bubble) produces a wide variety of iridescent hues such as are found in the glittering plumage of the hummingbirds. The glittering colors are lost in albinos, but the "blue structure" may be present, greatly weakened by the absence of the background of pigment. Albinos with this "blue structure" are sometimes very beautiful with the blue color showing as a delicate tint against the white feathers.

The most common sort of albinism in birds affects only certain feathers and is due to some injury or temporary defect in the skin where the feather pigment is produced. Thus abnormal white feathers may grow in the tail or wing or in white patches irregularly placed on the head or body. Birds thus affected sometimes recover in time and resume normal plumage at a subsequent molt.

Sometimes only one group of pigment is lacking while another remains, so that a tone of brown may be lightened by the absence of black, or an olive hue may be made grayish by the absence of yellow. In various ways, therefore, albinos are interesting aside from being uncommon enough to attract attention whenever they are encountered.

* * *

SIRS:

In the Safeway Stores Weekly Magazine there was an article by one W. W. Wheatly "Winged Wanderers," starting out: "Indians hunting in the fertile Yanaoca River Valley in Peru, recently unveiled a mystery of great interest to bird lovers in North America. . . . Until these numbered leg bands were received by the U. S. Fish and Wild Life Service, the swifts' winter home was a secret known only to the birds themselves."

I wonder if you could tell us more about this.

F. C. BENTLEY.
Springfield, Mo.

The following summary of events is offered by Dr. John T. Zimmer, Curator of Birds, the American Museum of Natural History:

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I have not seen the article by Mr. W. W. Wheatley, but the information quoted by Mr. Bentley is, in the main, correct. Ornithologists have long awaited definite information as to the winter quarters of the Chimney Swift, and every collection from tropical America was examined eagerly upon its receipt to see if a wintering individual had at last been found. The species had been seen as far south as Panamá, and it was presumed that the wintering grounds must be somewhere in the vast Amazonian region, but there was no proof of it. Then, in 1943, evidence began to appear.

In late March, 1943, Mr. E. Thomas Gilliard, of the Department of Birds of the American Museum, saw a flock of what he believed to be Chimney Swifts at Manaus, Brazil, but no specimens could be obtained. Early in 1944, a specimen collected thirteen years before at Santa Rosa, Colombia, was sent to the Museum for identification. This was the first example known to have been taken anywhere in South America, but, judging by the date, it was probably a migrating individual on its way northward and not in the heart of the winter range.

In May, 1944, the U. S. Fish and Wildlife Service in Washington, D. C., received from the American Embassy in Lima, Perú, thirteen numbered leg-bands recovered from birds killed by Indians some six months previously on the Río Yanayacu, in northern Perú. The bands were those which had been placed on Chimney Swifts in various places in the United States from 1936 to 1940, inclusive.

That is how it was found out where the Chimney Swift spends the winter and part of the route it follows on its way to this country. The full extent of the winter range and the course of travel have yet to be determined. Accounts of the three discoveries were published in *The Auk.**

* * *

Sirs:

I subscribe to your magazine and enjoy it very much. There are several cottonwood trees near my home, and I have noticed that on the stems of some of the leaves there is a round ball. It seems to be a swelling or an enlarged portion on the stem and it appears every year when the leaves drop off in the fall. The bulb soon bursts open and inside it are many tiny winged insects that resemble gnats. No one seems to know what they are and why they are there. I would appreciate it very much if you could tell me.

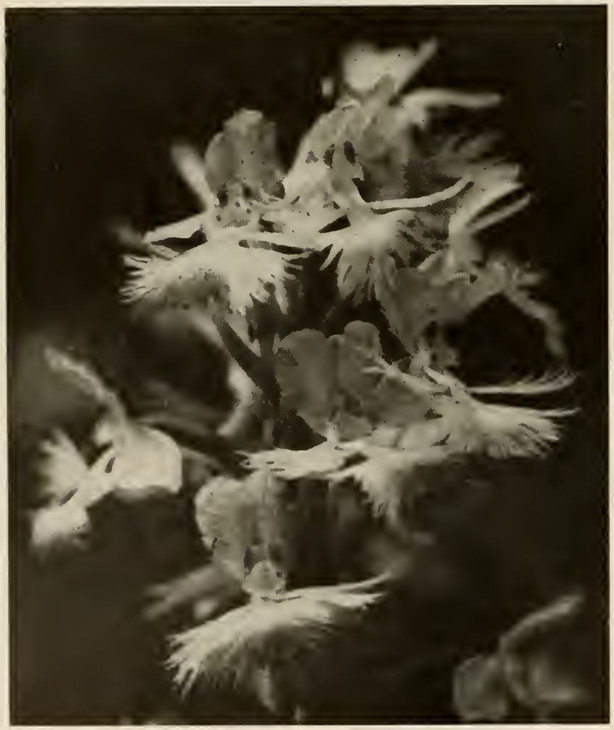
Nicholas Davis.
Carter, Mississippi

The growth noted by Mr. Davis on his cottonwood trees was almost certainly a gall. Galls are produced by insects of several different orders and also by mites. From Mr. Davis's statement that the swelling or enlarged portion of the stem housed "many tiny winged insects that resemble gnats," I would think that the galls in question may have owed their origin to some gall midge of the genus *Cecidomyia*, which has been reported to be present on certain members of the poplar group. On the other hand, aphids or plant lice of the genus *Pemphigus* are gallmakers on cottonwood trees and poplars. The different species of *Pemphigus* are seemingly partial to particular areas of the leaf. Thus *Pemphigus populicaulis* makes a gall of somewhat globular shape, ¼ to ½ inch in diameter, at the base of the leaf, while *Pemphigus populi-transversus* produces an oval, rather elongated gall on the petiole. The gall of *Pemphigus populi-venae*, on the other hand, occurs on the midrib of the leaf and is light red.

It is not always easy to determine the tenants of a gall unless a microscope is available, and then there is the further difficulty that the occupants are not always members of the same species that brought the gall into being. For sometimes parasites prey upon and replace the original occupants, while in other cases inquilines (or unbidden guests) share with the host species the food abundance that the gall provides.

Herbert F. Schwarz,
Acting Chairman and Research Associate, Department of Insects and Spiders.
The American Museum of Natural History
New York, N. Y.

A large purple fringed orchid, one of the most delicate and beautiful of our native species. The plant was found and photographed in northeastern Maine, by Henry Tamar



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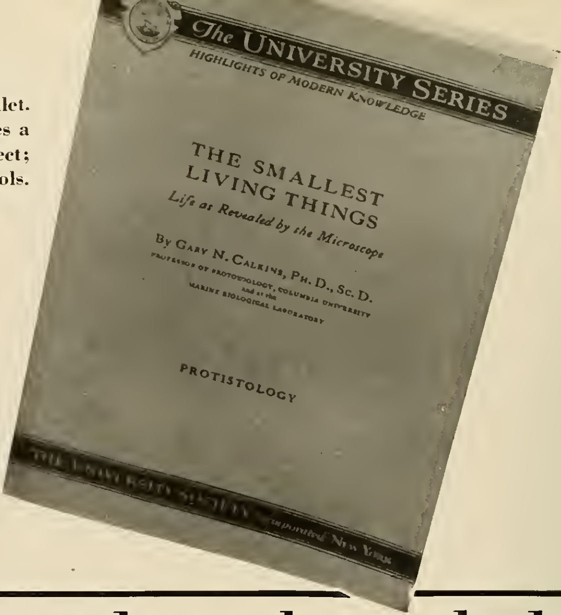
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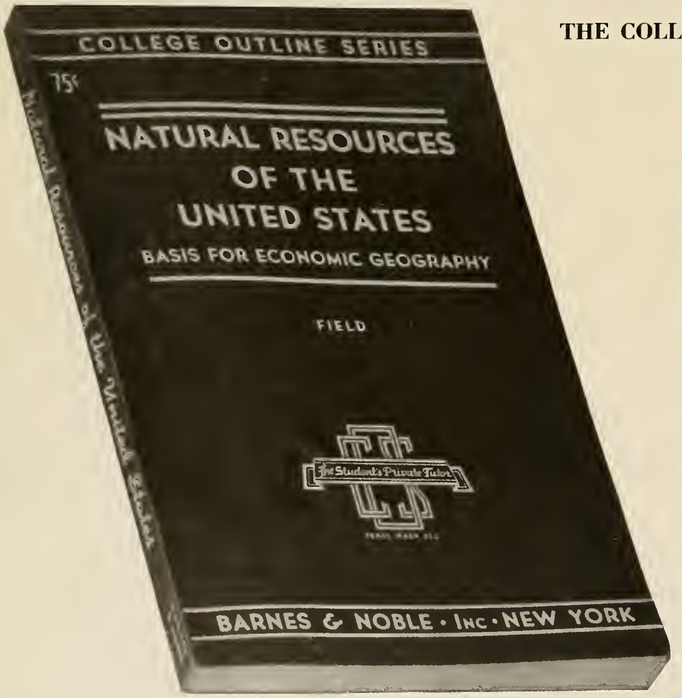
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L E T T E R S

Sirs:

I am going to propound a question which I am sure has come to the minds of many people who have read the article "Bombs from Interstellar Space" by Hobart E. Stocking, which appeared in the January 1944 number of Natural History Magazine. Would a re-examination of all the evidence and circumstances associated with the Siberian Meteorite disclose the release of atomic energy as we know it today? This was indeed a gigantic explosion, and the accounts of the atomic explosion given by eye witnesses in New Mexico and elsewhere would seem to indicate similarities. It seems to me that it would be difficult to account for the release of such an enormous quantity of energy in any other manner . . .

F. C. Holtz.

Springfield, Illinois.

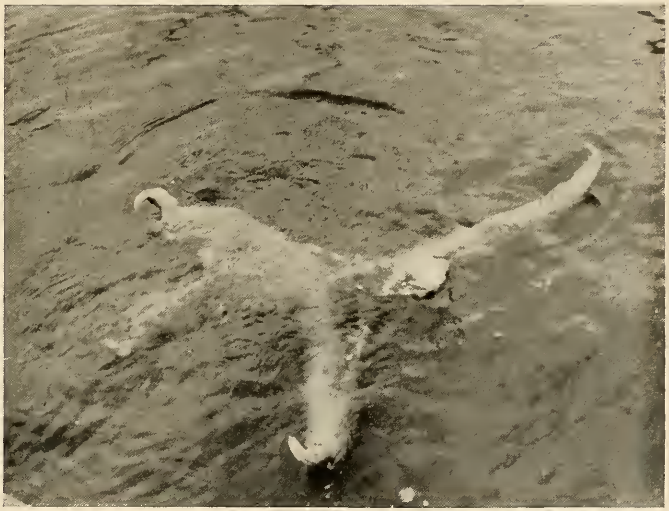
The question whether or not the meteor craters near the Stony Tunguska River in Siberia were caused by the release of atomic energy is a natural one in view of recent developments. The same question has recently been asked about the craters on the Moon, and it might well be extended to include all the known meteor craters on the surface of the earth.

The greatest fall of meteorites in historic times was the Siberian fall, which occurred on June 30, 1908. The craters produced by this fall were first visited by Professor L. Kulik, who has made, in all, four expeditions to the vicinity. He reports a group of craters ranging in size from 30 to 150 feet in diameter. Although he found no meteoric material, he considered them typical meteor craters.

There seems to be no more reason to believe that the Siberian Craters were caused by the release of atomic energy than that Meteor Crater in Arizona, which is the largest one known in the world, was produced in this way. The energy of onward motion of the mass of meteoric material is abundantly sufficient to account for the formation of the crater in any case. Upon striking the earth, the energy of onward motion of the meteorite or meteorites would instantly be transformed into heat. The water in the soil would be suddenly changed to steam. At the relatively low speed of 10 miles per second, according to the calculations of Professor F. R. Moulton, the energy released by a large mass would be sufficient to vaporize both the material of the meteorite and the material encountered. And the meteorite would carry with it a large mass of greatly condensed, and consequently heated, air. The result of the fall would be a violent explosion, and it is the explosion that apparently has much more to do with the formation of a meteor crater than the splashing effect of the impact.

It seems unnecessary to call on the release of atomic energy to account for the Siberian or any other meteor craters. And then it will be recalled that the so-called crater formed at the time of the New Mexico experiment with the atomic bomb was a huge pressure *dent* in the ground, lacking the elevated rim characteristic of meteor craters.

Clyde Fisher.



Sirs:

I wonder if many observers have seen a three-toed sloth swimming the backstroke, as shown in this snapshot of one doing it in the Berbice River in British Guiana.

On its back in the water, a sloth cranes its head around to survey the course and swims an overarm backstroke, using form that could not be criticized in the Olympic Games. It gives one a shock to see the animal go through this series of actions that is always associated with human performers; it could not be much more surprising to see it smoking a pipe.

A sloth normally will not swim in this position, I suppose; but when placed in the water on its back, it will make no effort to right itself, and will swim indefinitely without turning over. Its progress is as fast or faster than when swimming on its stomach.

I wonder if any other animal is so constructed as to be capable of this feat.

Robert G. Worman.

South Britain, Conn.

* * *

Sirs:

The many beautiful photographs in each issue of Natural History undoubtedly account for the special attractiveness of the magazine to young and old . . .

It is a natural urge for the "woodland walker" and "field trip enthusiast" to try to capture some of the beauty he sees. Too many, however, express this urge by vigorously seizing any colorful plant or weed they chance to come upon. Then at the end of the trip, if not before, they throw away the wilted "mess."

The finer and more artistic tramper soon considers photography as an ideal

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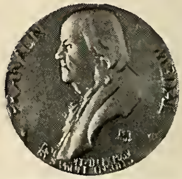

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The Magazine of the American Museum of Natural History

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VOLUME LV—No. 2 ★ ★ **FEBRUARY, 1946**

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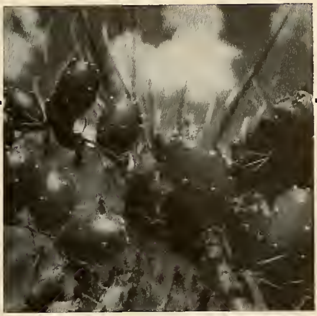

THE COVER THIS MONTH

The delicious fruits of the prickly-pear cactus are eaten by the Indians of many tribes in both North and South America, and are often called Indian figs. In Latin America, and in the western United States, the fruits of some species are commonly called tunas.

Not only are the fruits pear-shaped, but so is each section of the flattened, jointed stem—a two-fold reason for the last half of the name "prickly-pear." The first half of the name is due to the fact that most species of the plant are spiny or prickly. The fruits have cushions of very fine barbed bristles, quite evident in this photograph. One soon learns to avoid them. It is interesting to observe how skillfully and rapidly the Mexican Indian women can peel these fruits without allowing the bristles to touch their hands.

The flattened, pear-shaped sections of the stem of the cactus are commonly mistaken for leaves, but since fruits never grow upon the leaves of any plants, it is evident that they are not leaves. In fact, the leaves are very small, scale-like, and soon fall off. These small leaves, in the axils of which the spines grow, are seen only on the younger branches or sections of the stem. The flowers of the prickly-pear cactus are large and brightly colored—yellow, red, or purple, depending upon the species. The plant shown is *Opuntia Engelmannii.*

One or more species are the host-plants of the famous cochineal insect that furnishes a brilliant scarlet dye, and the pigment carmine.

Clyde Fisher.

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TREES THAT PAY DUES

One of the most unusual associations in the world is the Louisiana Live Oak Society, whose members are all trees

By DOLORES BUTTERFIELD JEFFORDS

THE founder of this society of trees was Dr. Edwin L. Stephens, President of the Southwestern Louisiana Institute, at Lafayette. Each member must have a human sponsor, and must be a hundred years old or more. If the exact age of the tree is not known, a girth of 17 feet, four feet above the roots, is claimed by experts to establish its age conservatively at more than a hundred years.

Members pay dues of 25 acorns a year. These acorns are planted in the live oak nursery at Southwestern Louisiana Institute, and the seedlings are later distributed.

The sponsor, or "attorney," of a member of the society vouches for the history and age of the tree, collects and remits its dues, and guarantees its preservation. An interesting provision of the society's constitution states that, "Members shall not be whitewashed. Violation of this law shall be punished by expulsion—and the attorneys for such members shall be disbarred from practice."

➤ "COUNCILOR OAK" on the lawn of the Garner Tullius Place is the 2nd Vice-President of the Biloxi Live Oak Society, a related organization. Years ago the Indians held pow-wows here and roasted so many oysters under the tree that they almost destroyed it

Dr. Stephens, during his lifetime, was the only sponsor. At his death, however, his interesting hobby, intended to stimulate appreciation of Louisiana's beautiful live oaks and insure their care, was taken up by others, and the society's membership now numbers hundreds of venerable trees. Indeed, the Live Oak Society has been extended to Mississippi and Texas, and a junior branch has been formed for the preservation and enhancement of trees that have not quite reached the century mark.

The "president" of the Live Oak Society is the Locke Breaux Oak at Hahnville, on the Levee Road, near New Orleans. This great oak is 75 feet high, 35 feet in girth, and has a spread of 166 feet. Some of the other famous members are the Jean Lafitte Oak on Fleming Planta-

Bureau of New Orleans News photo

◄ THE PRESIDENT of the Society, the Locke Breaux Oak at Hahnville near New Orleans, is the world's largest live oak tree

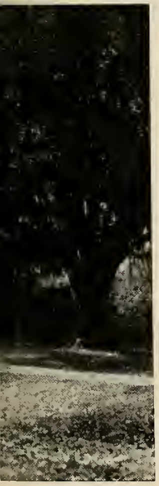
Photo by DeBrueys, from Bureau of New Orleans News

Photo by Mary Ethel Dismukes

tion, the Cleveland Oak at Avery Island—so named because it was greatly admired by President Cleveland—, and the Maryland Oak at New Roads, in whose shade James Ryder Randall wrote the immortal lines of "Maryland, my Maryland."

Less happy are the somber legends that surround the Duelling Oaks of New Orleans. These trees are more famous as a group than individually. Now standing in City Park, they were once outside the city—and many "affairs of honor" were conducted under their widespread limbs, when Louisiana was a French province and these old live oaks were the favorite duelling place of the fiery young bloods of Nouvelle Orleans.

Most historic of all, perhaps, are the Versailles Oaks, a grove of 79 magnificent trees which originally formed an avenue leading to the beautiful Versailles Plantation residence. This grove was the scene of the Battle of New Orleans and of Andrew Jackson's great victory in 1815. Steps are now being taken to have these grounds reserved as a national park—a fitting memorial to the men who fought and died to win that victory.



◄ CATHEDRAL OF OAKS. The Versailles Oaks, perhaps the most historic of all the members of the Society, originally led to the manor house of the Versailles Plantation. The grove was the scene of the Battle of New Orleans in 1815

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- - - - Edited by Pieter Honig and Franz Verdoorn

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491 pages, 134 figs. and maps.

THIS is an impressive collection of contributions on scientific research in the Netherlands Indies and its history and organization. A good number of them were specially written for the present volume. Others are reprints of important articles which had already been published elsewhere, many among them having been specially translated from the Dutch. Among the reprints are also chapters from such nineteenth century classics, as Wallace's *Malay Archipelago* and Forbes' *Wanderings in the Eastern Archipelago*, or of more recent books, as Fairchild's *Garden Islands of the Great East* and *The World Is My Garden*.

There are articles on geology, vulcanology, soil research, and climatology. Botany is especially well represented. Several of the articles in this field deal with the magnificent botanical garden and laboratory at Buitenzorg in Java. The subject of an article on "Wallace's Line in the Light of Recent Zoogeographic Studies" by Ernst Mayr of the American Museum of Natural History is of importance no less from the point of view of geography and geology than from that of zoology. Various contributions deal with the mineral resources of the East Indies, with forestry and agriculture, including research on such commercially important plant products as tea, tobacco, cinchona, and rubber; others with fisheries or with the raising of livestock. Several articles report on medical research, including among others research on the beri-beri problem, which ultimately played such a great role in the recognition of the importance of vitamins. Although in general the humanities proper have been excluded, several articles belong in this field, such as Broek's "Diversity and Unity in Southeast Asia," which deals with the anthropogeographic aspects of the region and opens up new economic and political prospects, and the reviewer's contribution on "Prehistoric Research in the Netherlands Indies." Franz Weidenreich of the American Museum of Natural History has contributed a highly interesting study of "The Puzzle Pithecanthropus," which is based on the latest discoveries, made just before the beginning of the war. This is the most up-to-date and authoritative treatise on the much discussed problem of the so-called "Java ape man."

The volume is richly illustrated and in its entirety gives a good and overall picture of the results achieved in most of the natural sciences relating to the Netherlands Indies. It bears testimony to the magnificent endeavors of the Netherlands Indies Government to promote scientific research by Dutch as well as by foreign scholars.

ROBERT VON HEINE-GELDERN.

RAFFLES, THE BIRD WHO THINKS HE IS A PERSON

- - by Zetta and Carveth Wells

G. P. Putnam's Sons, New York, $2.00
130 pages, 16 photographs

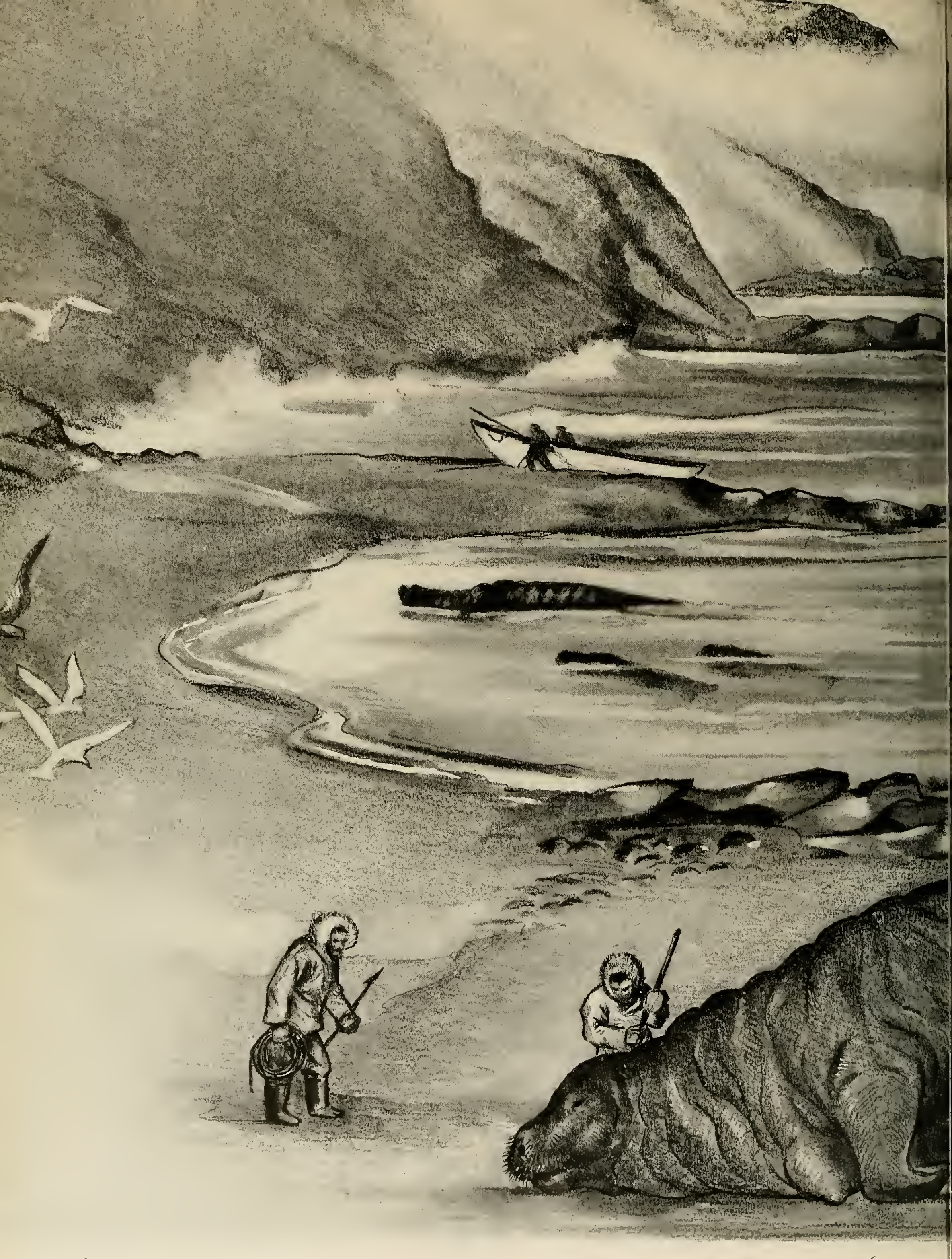
THE Malay grackle, celebrated for its ability to mimic the human voice, is best known as the "talking mynah." Almost every Zoo has one or more mynahs. Years ago in Washington a noted mynah was coached to greet a Congressional Committee, and did not fail to recite its query: "How about the appropriation?"

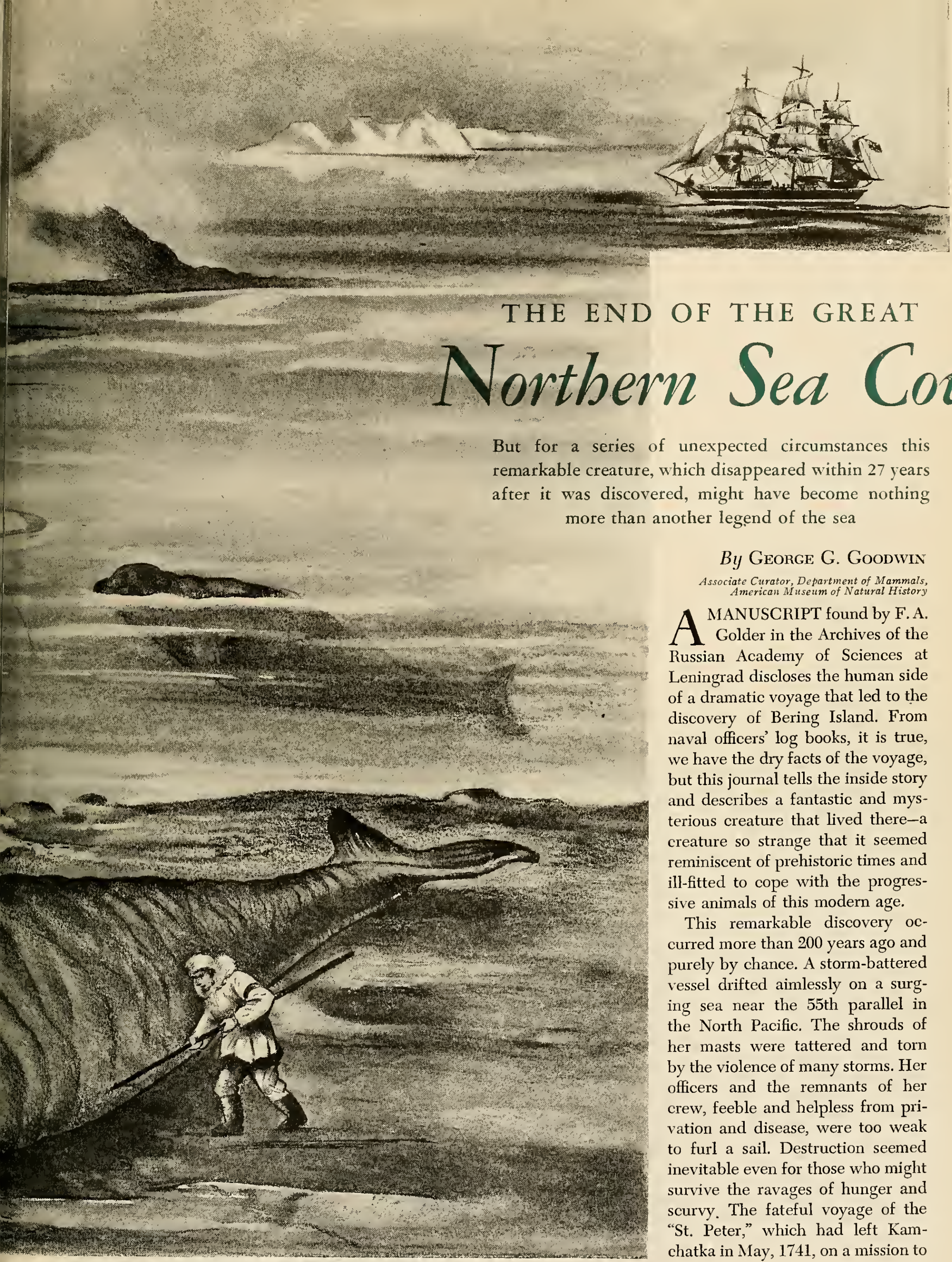
Now another mynah has achieved national prominence, as a radio star. It says the right thing at the right moment, and has a vocabulary of unusual variety. Zetta and Caraveth Wells brought it from Malaya at an early age, and their skillful training and care have been richly rewarded. They named it in honor of the founder of the city of Singapore.

Lowell Thomas's remark that Raffles thinks he is a person need not be disputed. Such a bird becomes so attached to its human foster parent as to forget its avian connections. Yet Mrs. Wells exaggerates when she claims that Raffles always knows what he is talking about. If his remarks and his music are so appropriate, the explanation is doubtless to be found in his expert response to a great many cues or signals. For this training Mrs. Wells deserves admiration.

Raffles is exceedingly sensitive to excessive heat and cold. His transcontinental travels have required devoted chaperoning; his diet is as carefully supervised as that of a child. Besides performing on stage, and for the screen and the microphone, this avian star has aided

Continued on page 95





THE END OF THE GREAT
Northern Sea Cow

But for a series of unexpected circumstances this remarkable creature, which disappeared within 27 years after it was discovered, might have become nothing more than another legend of the sea

By George G. Goodwin

Associate Curator, Department of Mammals, American Museum of Natural History

A MANUSCRIPT found by F. A. Golder in the Archives of the Russian Academy of Sciences at Leningrad discloses the human side of a dramatic voyage that led to the discovery of Bering Island. From naval officers' log books, it is true, we have the dry facts of the voyage, but this journal tells the inside story and describes a fantastic and mysterious creature that lived there—a creature so strange that it seemed reminiscent of prehistoric times and ill-fitted to cope with the progressive animals of this modern age.

This remarkable discovery occurred more than 200 years ago and purely by chance. A storm-battered vessel drifted aimlessly on a surging sea near the 55th parallel in the North Pacific. The shrouds of her masts were tattered and torn by the violence of many storms. Her officers and the remnants of her crew, feeble and helpless from privation and disease, were too weak to furl a sail. Destruction seemed inevitable even for those who might survive the ravages of hunger and scurvy. The fateful voyage of the "St. Peter," which had left Kamchatka in May, 1741, on a mission to discover a passage across the North Pacific to America, was fast drawing to a close. When all hope of survival seemed gone, a cry of "*Land!*" brought renewed strength to the dispairing crew. Even though he was ravaged with fever, the Commander, Captain Vitus Bering, a stalwart Dane, dragged himself on deck to see the promised land.

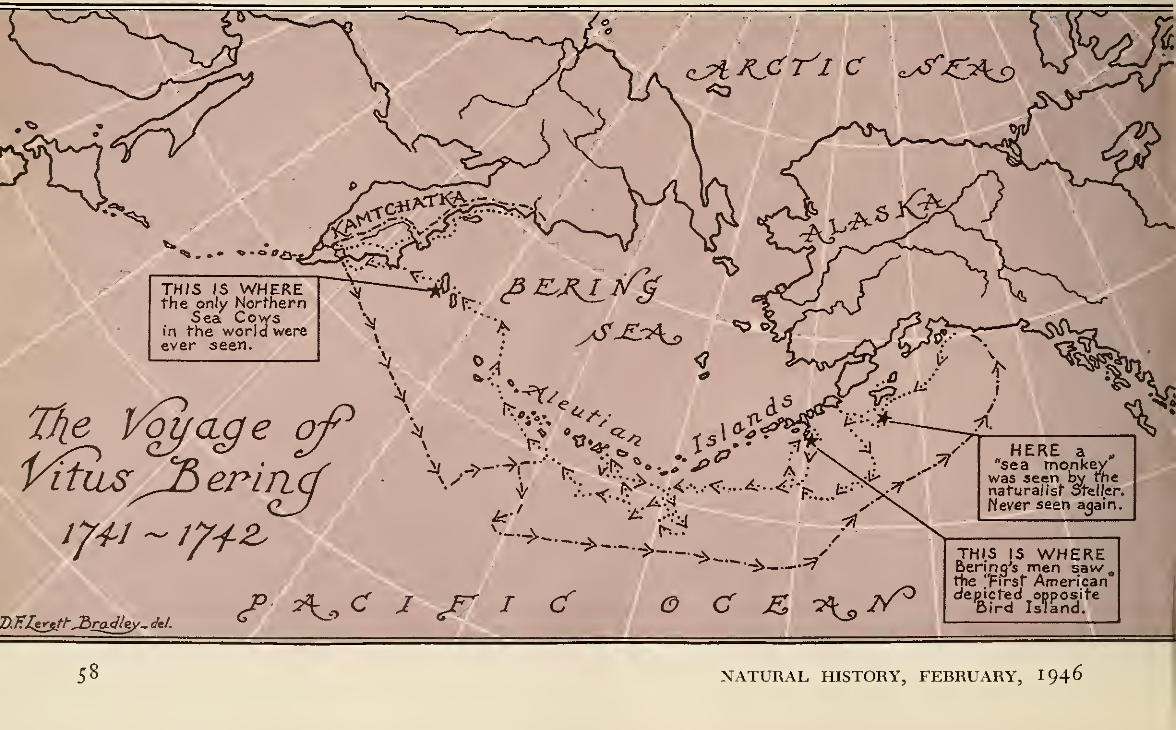
As the doomed vessel drove onward, hope again dwindled in the hearts of the valiant crew, for between them and the safe harbor breakers roared over a chain of fatal reefs that could but spell destruction for them and their craft. Mustering all the strength of the able few, two great anchors were heaved overboard but all to no avail. No cable could hold the vessel in that turbulent sea.

The end of the good ship, however, was not to be just yet. By some merciful power, a huge swell lifted her high at the crucial moment and she rode gallantly over the reef and into a calm and sheltered harbor. Immediate danger now over, all effort was made to get the sick and dying ashore and to procure fresh food and water. The tragic end of the Commander, in whose honor the island was named, came shortly after he was carried ashore, and the vessel itself was later hurled high and dry on the beach by a great sea.

It was a strange island paradise that these mariners had chanced to find, unspoiled by white man or native. The wild creatures that lived in harmony on its shores did not know the meaning of fear and met the visitors with bewildering expectation; but not for long were they left in doubt of man's unconquered desire to kill.

Strangely enough the first of the islanders to meet the sailors was a band of little blue foxes—close relatives of the Arctic White Fox, which had, no doubt, arrived there in much the same manner as the shipwrecked crew of the "St. Peter," but on drift ice. There was found no other form of true land animal on the island. These foxes, having no enemies, had increased to a number beyond the capacity of the island to support, and they now welcomed the newcomers as a possible source of sustenance. Unhesitatingly, they followed the sailors around, crowding into their tents and dugouts, and mischievously stealing all edible things they could carry away. They impudently watched everything that went on, and when a cache of food was raised in the air out of their reach, they cunningly undermined the posts so that it would fall down; then with incredible skill and speed they fled with the spoils. If they failed to bring a cache to earth in this manner, they would shinny up the poles and make short work of the store. Every morning the blue foxes could be seen patrolling the shores among the sea lions and fur seals lying on the beach, sniffing those that were

➤ THE NORTHERN SEA COW, drawn in company with a fur seal and a sea lion: one of the only three representations of the great animal drawn under the direction of someone who saw it. This is from Waxel's chart of the voyage of Vitus Bering's ship, "St. Peter"


ARCTIC SEA
KAMTCHATKA
ALASKA
BERING SEA
THIS IS WHERE the only Northern Sea Cows in the world were ever seen.
Aleutian Islands
The Voyage of Vitus Bering 1741 ~ 1742
HERE a "sea monkey" was seen by the naturalist Steller. Never seen again.
THIS IS WHERE Bering's men saw the "First American" depicted opposite Bird Island.
PACIFIC OCEAN
D.F.Levett Bradley-del.

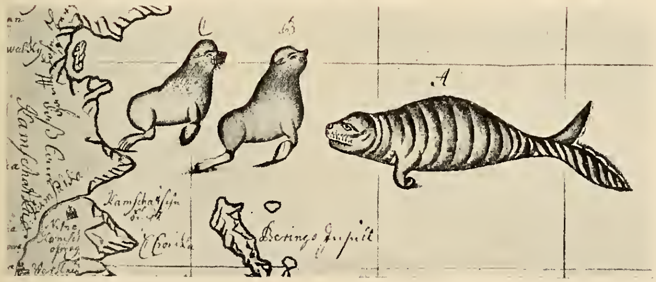
asleep to see whether or not there were any dead among them. They knew that it was not unusual for some of the baby sea lions to be crushed by their parents during the night.

It was not long, however, before their appetites wore out their welcome with the sailors and no amount of chastisement or torture could discourage or drive them away. A constant war ensued, but at fast as one batch of foxes was mercilessly killed another moved in to take its place. So bold did they become that they even attempted to tear a man's shoes from his feet. Small wonder that the foxes haunted the white man's camp and coveted his store of food, for they had been dependent on the morsels of food cast up by the sea and the few sea birds they could stalk.

Unfortunately the foxes served no practical purpose except as a garbage disposal corps. As food, their flesh was unpalatable. But the sea otter, present in large numbers, proved excellent eating. These otters lived singly and in pairs and herds, but just how many were seen together the manuscript does not state. Between November 6, 1741, and August, 1742, over 700 sea otters were killed and eaten on the island. These playful creatures hauled out on the rocks or open beaches to rest and sleep, or romped on the shore like children. Occasionally they extended their excursions half a mile or more from the water's edge. At first these animals, when asleep, fell easy prey to the sailors, who quietly stole in between them and the sea and then clubbed them as they tried to escape. The sea otters soon learned to distrust the invaders and kept constant watch, rarely settling down to rest without first surveying the beach in all directions for possible danger. Some that had apparently dozed off were seen to jump up with a sudden start and look anxiously around as if they had just remembered the presence of danger. Where a herd came ashore to rest, it became their custom to post a sentinel to keep watch. They seemed almost human in their habits and were pleasing to watch. Usually a family would congregate together, the male, female, half-grown young, and the nursing babies. The mother's love for her young was so strong that she unhesitatingly exposed herself to certain death rather than desert her offspring. In flight, the parents carried their young in their mouths, herding the older ones before them. If they had the luck to escape into the sea, they lost no time in mocking their pursuers in a very amusing manner, bouncing up and down in the water and throwing the babies in the air and catching them in their arms. They had a most fascinating manner of shading their eyes with a front paw as if to scrutinize more closely the men on shore. When a young sea otter was taken from its mother, she cried bitterly like a child, and if it was not returned she grieved so much that within a few days she became sick and feeble.

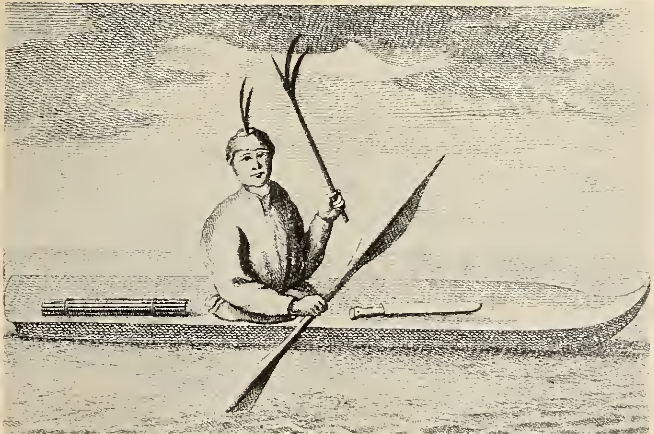
For more than six months the sea otter served almost exclusively as food for the shipwrecked crew. (It is interesting to note here that the sea otter has now completely changed its mode of life. No longer does it trust its fabulously priced pelt on land but spends its entire life offshore and even sleeps floating on its back in a bed of floating kelp, with arms folded over its heart.) Fur seals and sea lions and true seals were there in abundance, but they had learned all too quickly the danger of man and kept at a safe distance from him. Only an occasional individual was captured, and they could not be considered a staple article of food. Some new and easy source of food for the crew had to be secured or the work of building a boat for their escape from the island would be greatly curtailed.

Efforts were now made to capture a strangely fashioned creature that was browsing on the abundant seaweed growing along the shores of



▼ The "First American" in his skin boat, as seen by the men of Bering's expedition in the vicinity of Bird Island, in the Shumagins. The craft is basically similar to an Eskimo kayak, which was used also by the Aleuts and the Kodiak Islanders

From Krasheninnikov, Opisanie Zemli Kamtchatki



the island, especially where the streams emptied into the ocean. The manuscript does not tell us what they thought of this strange form of animal life when it was first seen. Their amazement must have been truly great, however, when the first specimen was examined and found to be neither seal, porpoise, nor whale. Luckily, Commander Bering was accompanied on this fatal voyage by a German scientist, George Wilhelm Steller, the first and only trained naturalist that ever had an opportunity to study this amazing creature alive and in its natural surroundings. Steller carefully recorded his observations on its habits and gave a detailed description of its external and internal structure. Even at that, some of us now might well doubt that this was not the product of a fevered imagination were it not for the fact that Dr. Leonhard Stejneger collected skeletons of the animal on Bering Island in 1883 for the Smithsonian Institution. A skull from Stejneger's collection came to the American Museum of Natural History, where it can be seen today, exhibited on the third floor along with a small restoration of the animal in life.

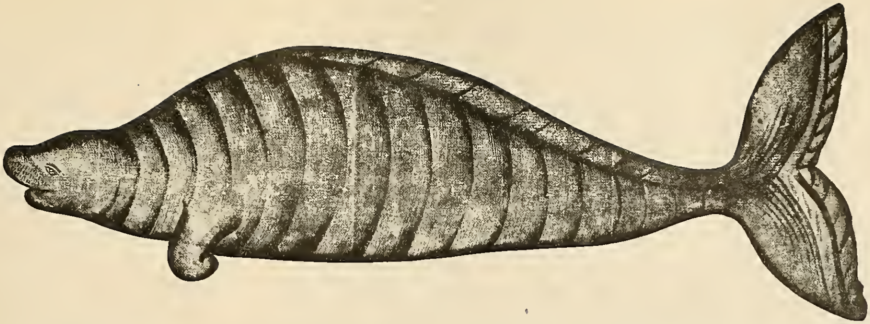
We know now that this animal belonged to the order Sirenia, and to the family of sea cows. It was a not too distant relative of the warm water Florida manatee and the African dugong and has been given the name of Northern or Steller sea cow. Its mysterious origin is a question that no one so far has been able to solve. Was it a lone survivor from an age when the Arctic basked in tropical sunshine and palm trees flourished in northern latitudes? Or did it belong to some great land mass that has long since disappeared below the surface of the sea? This much we do know, that never in the time of modern man has it existed anywhere except at this one tiny isolated spot, Bering Island, and then only in the shallow shore water and bays. It neither crawled ashore like the seals nor extended its activities to the deep sea. That it did not extend its range to other parts of the North Pacific is easily explained. Those ferocious tigers of the sea, the killer whales, would have made short work of such a defenseless creature were it to venture too far from the protective shallow shore waters.

Unfortunately, the Northern sea cow was completely exterminated within 27 years after it was first discovered. The only clear, firsthand information that we have about this animal is found in Steller's account. A drawing of the sea cow made under his direction was lost, but Waxel, a member of the navigation crew, shows a crude representation of the creature on his chart of the voyage.

From the skeletons now in the Smithsonian Institution we can figure that a full-grown animal had a length of 25 or 30 feet. This deduction corresponds closely with Steller's account, which gives the measurements of the largest specimen as four or five fathoms (24 to 30 feet) and their estimated weight as 200 Russian poods, or nearly four tons. Steller's description and measurements, while acurate in detail, leave a rather vague idea as to the general appearance of the animal. Apparently he never actually saw a Florida manatee or an African dugong and had no mental conception of these animals to use for comparison. He said it was like no other animal but had its own peculiar appearance. He described it as having forward parts like a seal and a rear half much like a fish. The skull, he said, resembled that of a horse; but the head in the flesh was more like a buffalo's, especially the lips. In place of teeth, which were lacking altogether, there were two strong horny plates, one of which was set in the palate and the other in the lower jaw in opposition to it. These obliquely furrowed plates served to grind up the seaweed on which the animal fed. The lips were armed with many strong bristles about the thickness of chicken quills. For an animal of this size the eyes were small—according to Steller, no bigger than sheep's eyes. There was nothing more than a small hole for an ear, which could scarcely be detected in the grooves and wrinkles of the hide—no trace of an external ear. The head was attached to the body by a short, thick neck. There were no hind legs, and the extraordinary front paws consisted of only two joints, with no fingers or nails. The extremity of each had the appearance of being amputated and was covered with coarse calloused skin and shaped much like a horse's hoof, doubled under in a hook. These clubfeet were of no assistance to the animals when swimming. They served to pull the huge body along in shallow water when the creature was grazing and were also used to knock seaweed from the rocks. The back of the animal, Steller says, was formed like that of an ox, with median crest or backbone, on either side of which was a flat or hollow space along the back; the flanks were rounded. The belly, he says, was rounded like a frog's and at all times stuffed full of seaweed. The tail became gradually thinner toward the flukes, which consisted wholly of fat and gristle, and were horizontal and forked like those of a whale or porpoise. The hide itself was peculiar. According to Steller, it was blackish-brown and had an outer covering about an inch thick resembling the bark of a tree, full of grooves, wrinkles, and holes, especially about the head. This warty surface apparently took the place of hair in other animals and consisted of perpendicular fibers clustered in the form of bulbs that fitted together into delicate cavities in the skin underneath, giving an appearance much like the surface of a thimble. The outer skin was easily broken loose and served to cushion the animal when it came in contact with the rocks.

Steller's notes on the habits of this sea cow perhaps give us a better conception of the beast than his description of its appearance and are given here as translated by F. A. Golder:

> "These animals, like cattle, live in herds at sea, males and females going together and driving the young before them about the shore. They are occupied with nothing else but their food. The back and half the body are always seen out of the water. They eat in the same manner as the land animals, with a slow forward



WITH THE EXCEPTION of a very crude sketch in Pallas' *Zoographia Rosso-Asiatica,* this is the only other representation of the Northern sea cow made under the direction of someone who had seen the animal. It was probably drawn by Plenisner and was included in the Waxel *Tsarkoye Selo* manuscript, subsequently published by Büchner. Bones of the animal and eyewitness accounts of it complete our knowledge of the extinct monster

movement. They tear the seaweed from the rocks with their feet and chew it without cessation. However, the structure of the stomach taught me that they do not ruminate, as I had at first supposed. During the eating they move the head and neck like an ox, and after the lapse of a few minutes they lift the head out of the water and draw fresh air with a rasping and snorting sound after the manner of horses. When the tide falls they go away from the land to sea but with the rising tide go back again to the shore, often so near that we could strike and reach them with poles from shore. They are not afraid of man in the least, nor do they seem to hear very poorly. Signs of a wonderful intelligence I could not observe, but indeed an uncommon love for one another, which even extended so far that, when one of them was hooked, all the others were intent upon saving him. Some tried to prevent the wounded comrade from being drawn on the beach by forming a closed circle around him; some attempted to upset the yawl; others laid themselves over the rope or tried to pull the harpoon out of his body, in which indeed they succeeded several times. We also noticed, not without astonishment, that a male came two days in succession to its female which was lying dead on the beach, as if he would inform himself about her condition. Nevertheless, no matter how many of them were wounded or killed, they always remained in one place.

"Their mating takes place in June, after protracted preludes. The female flees slowly before the male with continual turns about, but the male pursues her without cessation. When these animals want to take a rest on the water they turn on their backs in a quiet place in a bay and allow themselves to drift on the water like logs.

"These animals are found at all seasons of the year everywhere around the island in the greatest numbers, so that the whole population of the eastern coast of Kamchatka would always be able to keep itself more than abundantly supplied from them with fat and meat."

Steller's manuscript does not give any closer estimate of the number of sea cows at Bering Island or the size of the herds than that they were there in great numbers. Stejneger, who in later years visited the island and was familiar with the natural conditions there, figured that 1500 individuals would perhaps be too high an estimate. He said that it must be remembered that the Northern sea cow was a very large, bulky animal, 20 to 30 feet in length, and that it lived chiefly near the mouths of the rivulets, feeding on the seaweeds, especially *Lampellaris.* There are no more than 15 such places on the island; and if each of these were regularly visited by an average of 100 individuals, one would easily be impressed by their abundance, especially if they were divided into herds of from 10 to 20 individuals.

This story of the animals seen on Bering's last voyage would hardly be complete without some reference to the strangest and most fantastic of them all.

The precise manner in which Steller portrayed his observations inspires confidence in his work, but there is one section in the manuscript that, to say the least, is definitely puzzling. During the early part of this voyage Steller records seeing what he calls an unusual and unknown animal. For the lack of a better comparison he likens it to Gesner's *Simia marina danica* or sea monkey. He describes it as about 2 Russian ells (56 inches) in length, with a head like a dog, pointed erect ears, large eyes, and a long, hairy body, reddish in color. The tail, he said, was divided into two fins, like a shark's, the upper half being twice the size of the lower. It had long whiskers like a Chinaman and no fore limbs.

This so-called sea monkey followed the vessel for two hours, playfully bouncing in the water (sometimes in an erect position like a man) and diving swiftly under the bow of the ship. At times it followed so closely that it could be reached with a pole. Eventually it went off to sea but reappeared again on several occasions. The general assumption would be that this was a sea otter or a sea lion, but it must be remembered that Steller was too familiar with these animals to fail to recognize them. Furthermore, he had plenty of opportunities to examine the curious creature at close range. Needless to say, there is no animal either living or extinct known to science that comes anywhere near Steller's description.

SPINIFEX TOWN

By CHARLES P. MOUNTFOR

All photographs by the author

Drawings by Museum Illustrators' Cor

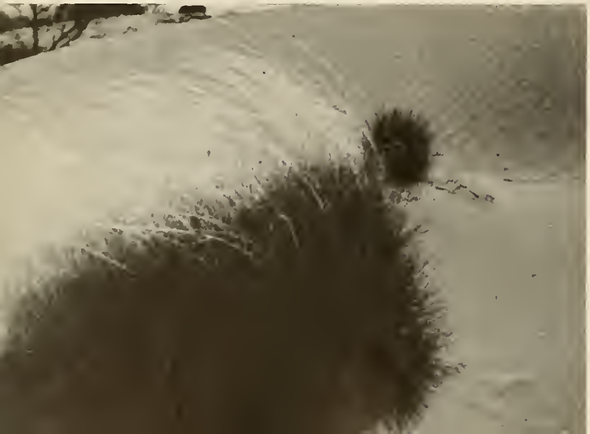
Tiny animal communities live their vari lives in the Australian desert, unnotic save by those who trouble to read the diary in the sand

I HAVE traveled almost 2000 miles on camel-back through the deserts of Central Australia, and most of the country I traversed was dotted with clumps of the unusual grass known as spinifex. From the back of a camel I had a new view of the ground, a bird's-eye view. But were it not for the interesting things I saw in the spinifex and on the sand, the journeys would have been most monotonous.

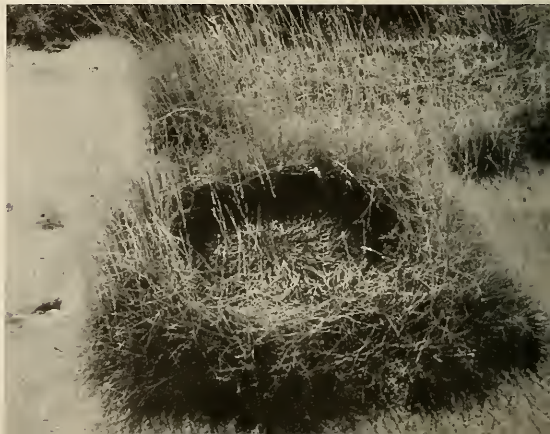
Spinifex, or to give it the scientific name, *Triodia*, covers the sandy desert and rough hillsides alike. It grows in circular clumps that propagate outward, just like the Fairy-ring Mushroom, familiar to many. One of the outer branches will bend downward, take root, and start a fresh plant. This process goes on until you sometimes see a complete ring of grass with an area of clear ground in the centre. I was always on the lookout for the complete spinifex ring, but in all my journeyings I saw only two. It was

◀ THE BACK OF A CAMEL offered a fine view of the myriad grass clumps that sheltered Australia's desert dwellers

▼ THE GRASS looks soft and downy here, but each tip is sharper than a needle



▼ A SPINIFEX RING beginning to form. The plant grows outward by bending down and taking root. The center dies



like searching for a four-leafed clover.

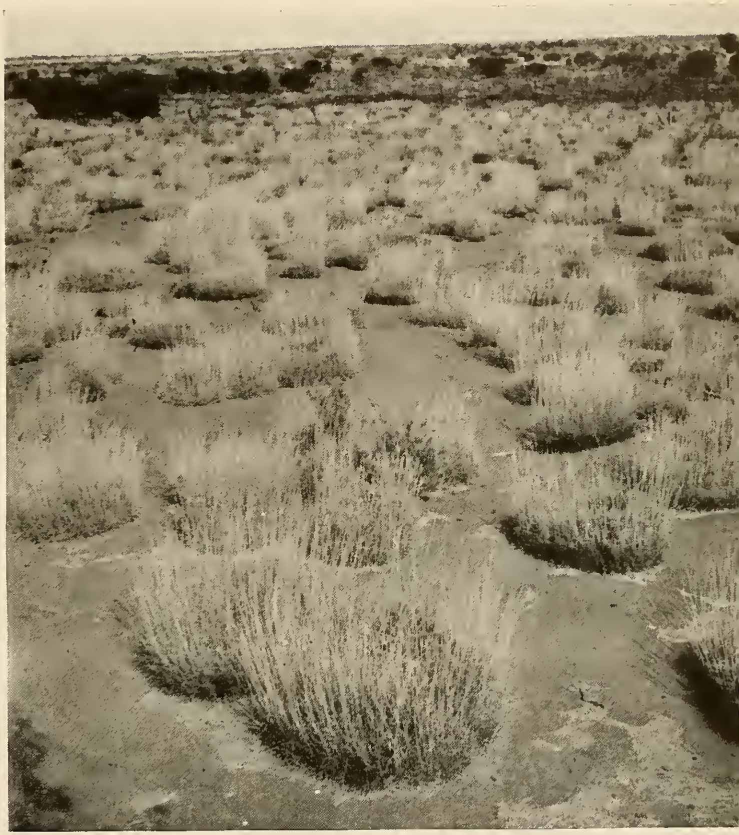
Every leaf of a spinifex bush is armed with a point sharper than the finest needle—so sharp, indeed, that it could penetrate even my heavy clothing. The natives would not walk on a bush consciously, and that is a tribute to its prickliness, for the sole of an aboriginal's foot is as tough as the tread of a motor tire. Nor would the camel string travel in a straight line across it, but would leisurely wind its way in and out among the bushes. Everyone and everything, except the tiny creatures who made it their home, had as little as possible to do with this unfriendly desert dweller.

And as the spinifex passed under my feet, day after day, week after week, I learned to recognize the tracks made by these small creatures. I saw also that in each bush, separated from the next by a space of clear sand, lived families of mice, lizards, small marsupials, and insects. They were self-contained communities, each intent on its own affairs and seldom, if ever, troubling about anyone else.

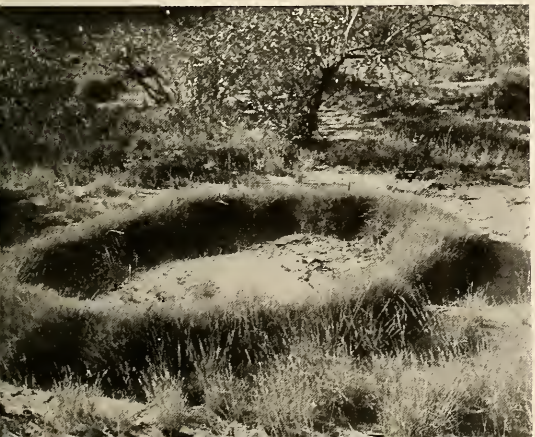
One day, as I idly watched from the back of my camel, I was struck by the resemblance between these little homes and those of a suburban area. Each had its own inmates; each was separate from the next. So I called them "Spinifex Towns."

In the cold mornings I would sometimes walk to gain a closer knowledge of the goings-on of these little people of Spinifex Town. It was a pleasant pastime. Here I was moving in a world apart, a world of tiny creatures. The tracks they left in the fine sand, as yet undisturbed by the day's breezes, told me so much of their movements that, although I did not know the inhabitants of the desert community, I knew much about their doings, their habits, and their personalities.

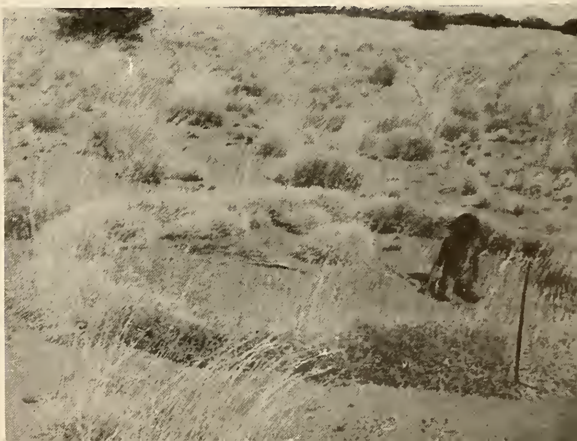
First there were the mice, our



Each spinifex town is self-contained and concerned chiefly with its own affairs



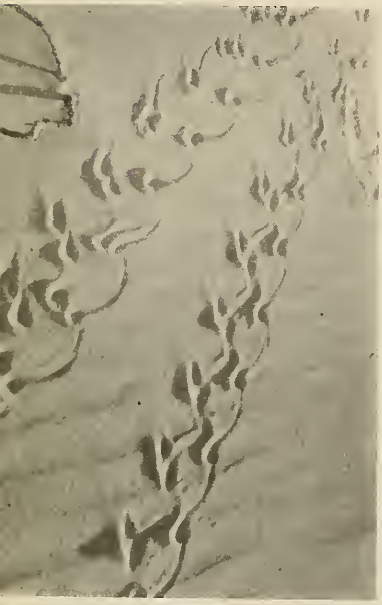
An almost complete spinifex ring



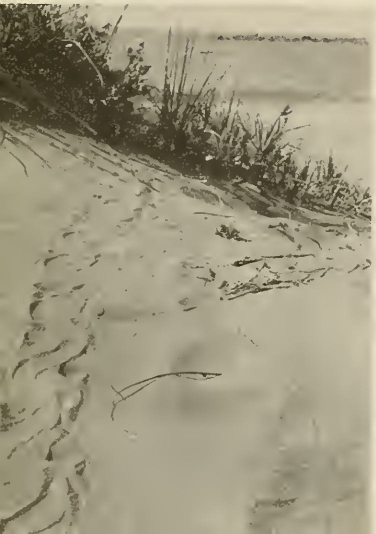
▼ One rarely sees a complete ring like this one

REPTILES

▼ A REPTILIAN ROMANCE, or "a-walking we will go"; the tracks of two goannas (*Varanus gouldii*)

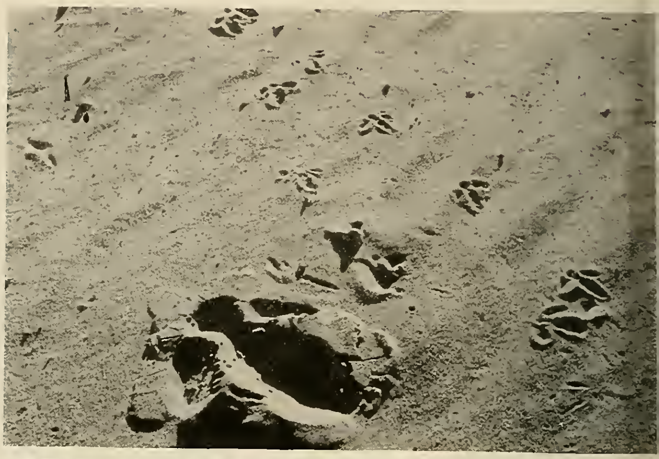


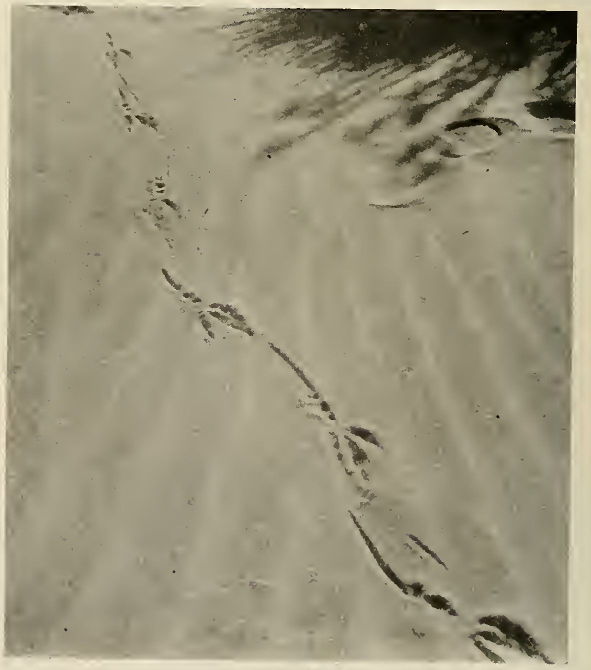
▼ A "SLEEPY LIZARD" (*Trachysaurus rugosus*) passed this way



BIRDS

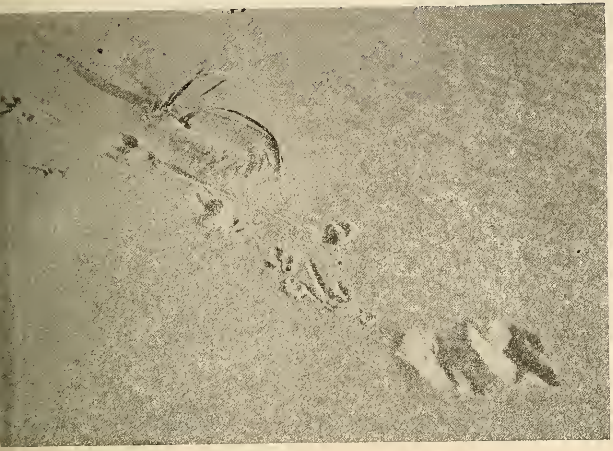
▼ FATHER EMU, second largest living bird, and his chicks, went out for a morning walk here. Male emu incubates the eggs and tends chicks

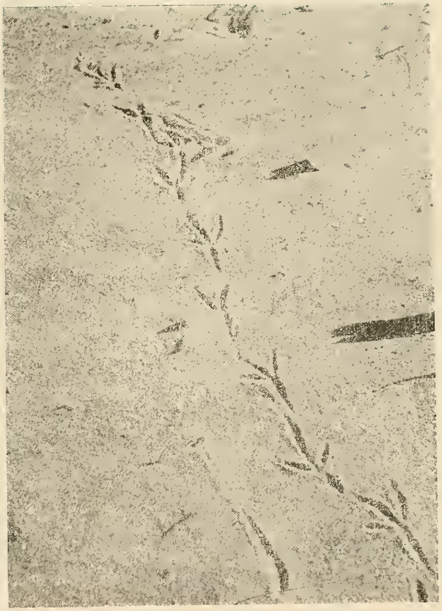




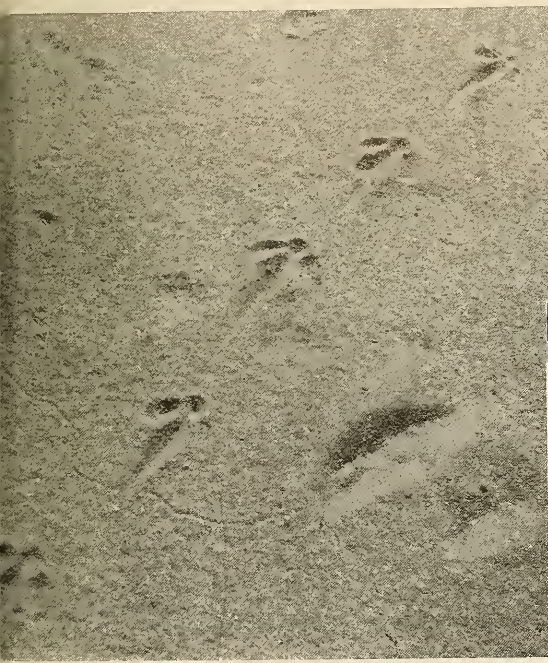
▲ CROW TRACKS among the transient ripple marks

▼ Where a pipit (*Anthus australis*) landed and walked away

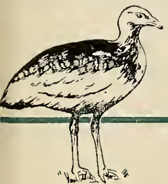




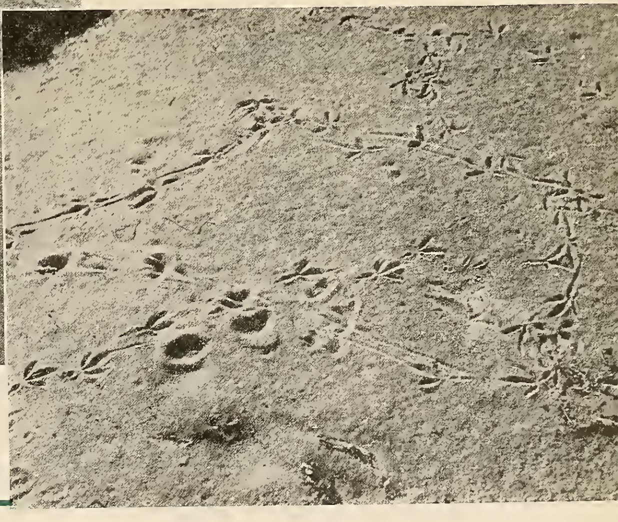
▲ Footprints of a mudlark (*Grallina cyanoleuca*)



▲ The trail of the Australian Bustard (*Eupodotis australis*)



▼ There was one little bird that never revealed his identity, but he was very much of a busybody



little domestic mice, who seldom went straight from one home to another. They would creep along the outside of a bunch of spinifex and then, with a quick rush, would break across the open space to seek shelter in a neighbor's house. The tiny marsupial mouse was almost as wary, but he often ventured farther afield. Occasionally I saw where one had made an exploratory journey into the larger spaces for some titbit, or to meet a friend.

As the day became warmer, the lizards started to wander about. They were the sleep-a-beds and never rose before the dew was off the grass. The little ones were as shy as the mice but much faster in their movements. They made swift journeys from one place to another, pausing now and again in the shadow of stick or a clump of grass to watch for intruders. They were so small and so light that their tracks were barely visible.

The sleepy lizards and goannas, on the other hand, moved deliberately from place to place, unhurried and unafraid, for who, except the eagle and man, could attack these giants of Spinifex Town?

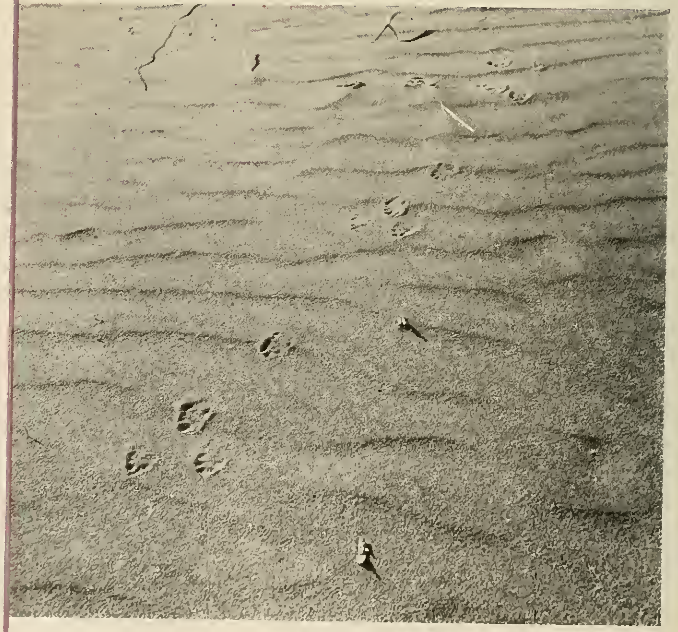
The personality of the birds, too, showed in their footmarks. The bombastic gait of the crow, that black robber of the "outback," was reflected in his swaggering tracks. The wild turkey (alas almost extinct now, where white man and foxes roam), pursued his way in a straight line, like the gentleman he is, unmolested and unafraid.

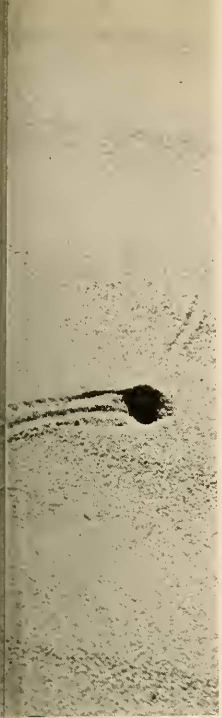
There was one little bird—I never found out who he was—who was such a busybody! I could trace where he rushed here, stopped, changed his mind, then tore off somewhere else. He hardly ever reached his destination before something diverted his attention, sending him off again in another direction. He must have been a very busy bird, and a tired one before the end of the day.

The rabbit was everywhere. The characteristic groups of little circular marks (three and one) showed his wanderings. How this little animal, who belongs to the greener places of the world, gathers food

MAMMALS

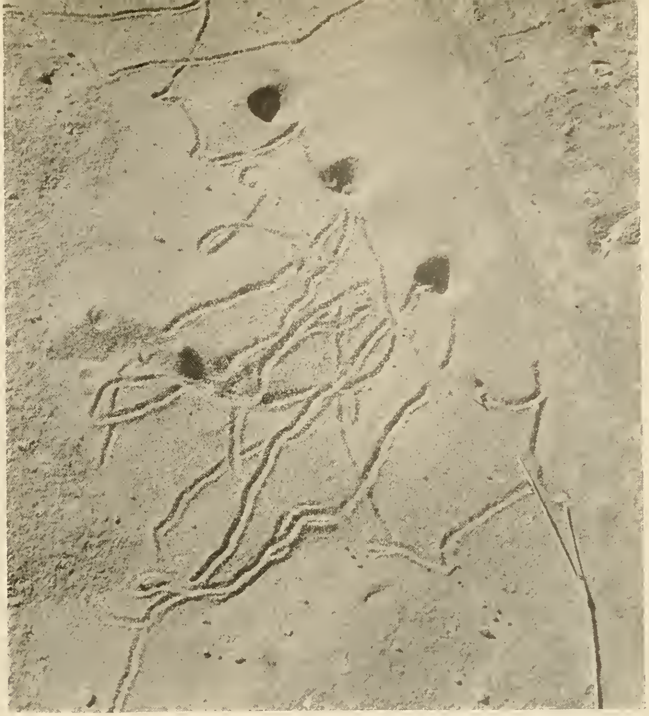
▼ THREE-AND-ONE: the tracks of a European rabbit moving along slowly



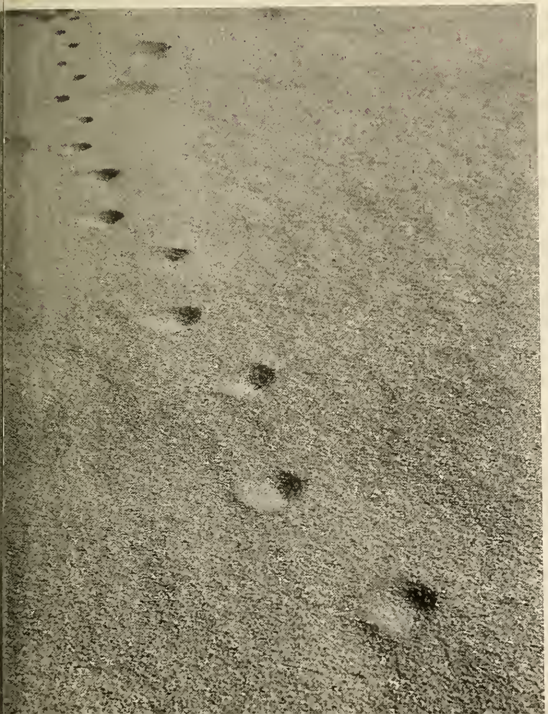


◄ A LARGE BEETLE, or perhaps a scorpion, changes his home

➤ MEANDERINGS of the ant lions, which will someday be lacewing flies. They construct funnel-shaped holes in the dust, bury themselves in the bottom, and live on ants that fall into the trap



▼ A DOMESTIC CAT that had gone wild



▼ THE DOMESTIC MICE would skirt one spinifex town and then make a dash to the shelter of a neighbor's house

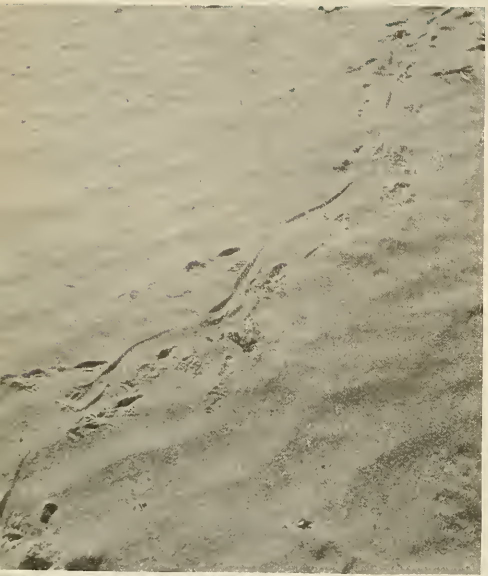
and water in this inhospitable country, where surface waters are nonexistent and rainstorms rare, was always a puzzle to me.

Then there were the insects, spiders, and all sorts of creeping things, who left evidence of their movements on the sandy page. I imagine they were a stupid crowd and that they must have often fallen prey to some watchful bird.

Tracks here, tracks there, tracks on all sides of me, made by little creatures that knew not man, for seldom does that supreme egoist of creation come their way. Yet each, living in his own sphere, was as much the work of the Creator as the visitor who watches their tracks and learns their ways from the back of a camel.

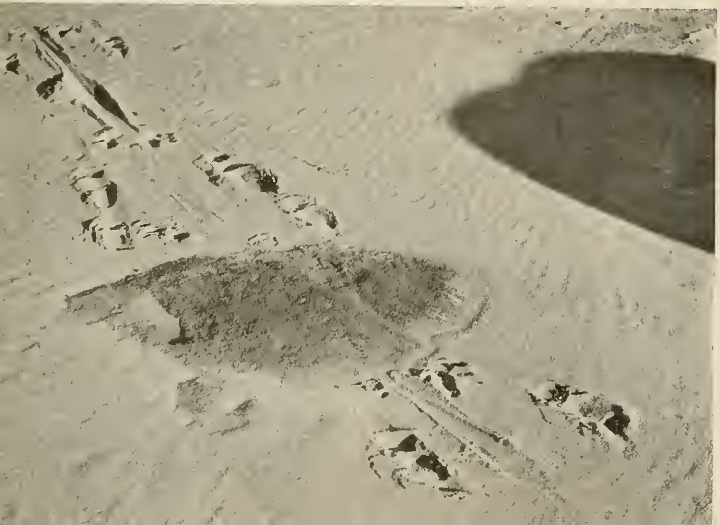
Now I have returned to the city, to the roar of traffic and other man-made noises. The quiet of the desert is but a memory. But when I see men scurrying about, seldom, if ever, troubling about anything but their own immediate business, my mind goes back to the peaceful sandhills, their little inhabitants, and the tracks so lightly made, so easily erased.

MARSUPIALS



◄ Tail and feet: the autograph of one of the smaller kangaroo-like marsupials, slowly pushing itself along with its "fifth leg"

▼ The euro, or Hill Kangaroo (*Macropus robustus*) left this trail. Large hind feet, small front ones, and tail are discernible



Okinawan

WHEN the Marines made that Easter Day landing on Okinawa, I never imagined that before a few days of combat were over I would be observing trapdoor spiders.

But one day after we had been on the island nearly two weeks, my company (G. Co., 29th Marine Regiment) w given the assignment of patrolling th Toguchi-Itomi on Motobu Peninsula an attempt to contact the second battalio operating in that area. Although ou course led us through enemy controlled regions, we met but light resistance until we were returning, when we ran into skillfully camouflaged Japanese ambush It was heavily supported by sniper, m chine gun, and mortar fire, which halted our advance. Every Marine was forced to dash for cover and concealment.

Jumping behind a stone wall, I searched the terrain for possible routes to advanc along and for possible enemy positions After straining awhile, I rested my tired eyes by gazing upon the mud-filled cracks of the wall. The soil of the wall, I noticed, was dry and adobe-like—almost as hard as rock. It was nearly bare of vegetation, but a near-by tree gave it shade

When you realize that the only sign of a trapdoor spider's nest is a hair-thin crescent line half an inch or so long, you may think that I had been getting down to details in the matter of concealment. But actually I had studied the California trapdoor spider (*Bothriocyrtum californicum*) and would recognize this line anywhere as the door to the silk-lined, underground dwelling of one of these ingenious creatures.

I saw one, then several others. Of course, my curiosity was immediately aroused. However, the chattering of a Japanese *nambu* machine gun and the cracking of bullets overhead brought me back, with the thought that I had perhaps not hidden myself as well as the spiders had.

Those few moments of scientific observation had eased the tension, but no further examination could be attempted.

The days that followed were filled with forced marches and bitter fighting, but two weeks later, the Marines had the situation well in hand: Motobu Peninsula and the entire northern two-thirds of Okinawa were declared secured. During a short rest period I was able to investigate my discovery further. Although this area was five or six miles from the scene of my initial observations, I began an intensive search.

The first nest had been found in a stone wall, so the natural place to look was along the walls of the many terraced embankments.

Careful and systematic searches for a couple of days in the cracks of these, however, failed to reveal even a single trap

TRAPDOOR *Spiders*

By ORTHELLO L. WALLIS
Corporal, United States Marine Corps Reserve

Photos by Lee Passmore

door. Knowing that the soil should not be too moist even in the rainy season, I did not bother with the walls supporting the rice paddies, for they were always very wet.

On the third day, when I was about ready to give up the search, I happened to recall that the other nests had been situated in a shady spot.

Following that cue, I soon found trapdoor spider nests right in my front yard, only fifteen feet from my foxhole shelter. They were shaded by cycads, those primitive, tropical plants intermediate in appearance between tree ferns and palms.

The first nest I found here was evidently that of a mature female, because it was surrounded by a half dozen tiny ones presumably built by her offspring.

I carefully removed the nests from the earth so that I could study them better. The tube of the large one had a diameter smaller than a dime, and its length was only two and a half inches. As for the spiderling nests, the trap door was only about twice the size of a pinhead! The tube was not more than seven-sixteenths of an inch long.

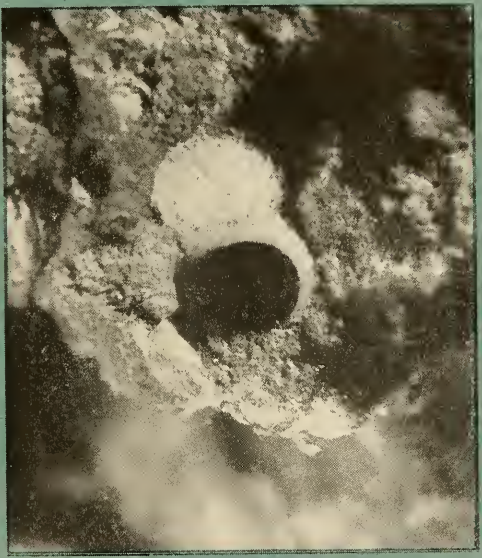
These "baby" nests, although miniature, were no less perfectly constructed. Every detail—the lid, the hinge, and the tube,—was as skillfully built.

The Okinawan spiders built their nests nearly straight into the side of the bank instead of digging them vertically into the earth as do the California spiders. These Oriental nests were single-door homes concealed by a tight-fitting, cork-type lid. The tubes did not branch. The inhabitants feed on small insects and catch their prey by springing forth from the trap door upon the unsuspecting creatures, and dragging them back into their nests to devour them.

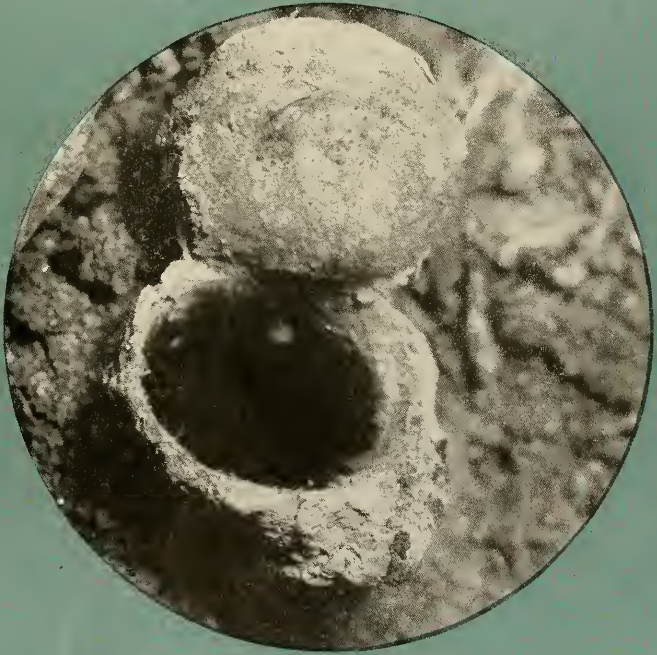
Against "unwanted guests" the spider protects itself by securely holding down the trap door with its claws. When I tried to lift the lids of several nests, the occupants held on determinedly for a few moments. They soon gave up, however, and darted down into the darkness of their homes.

All of the nests were located far within the cracks of the wall, where they could survive even during the rainy months, which begin in April or May. During this season, while the dirt is soft, the adult spider enlarges and repairs the tube in preparation for the next litter of spiderlings. A couple of the nests I dug up still had the ring of silk in the tube which had been used to seal the lid during the period of hibernation and baby-raising.

I mailed three mature and five "baby" nests, together with two live immature spiders, to my home in Julian, California. Considering the 7000-mile journey, the nests came through with relatively little damage, but the spiders perished.



▲ THE YOUNG spiderlings constructed miniature trap doors only about twice the diameter of a pinhead, yet no less perfectly built than their parents'. Every detail—lid, hinge, and tube—shows skillful workmanship



▲ THE NEST of the mature Okinawan spider had a trap door and tube smaller than a dime in diameter. The photograph shows the entrance enlarged about four times

HOW STRONG is the TRAPDOOR SPIDER?

By Walker Van Riper
*Curator of Spiders,
Colorado Museum of Natural History*

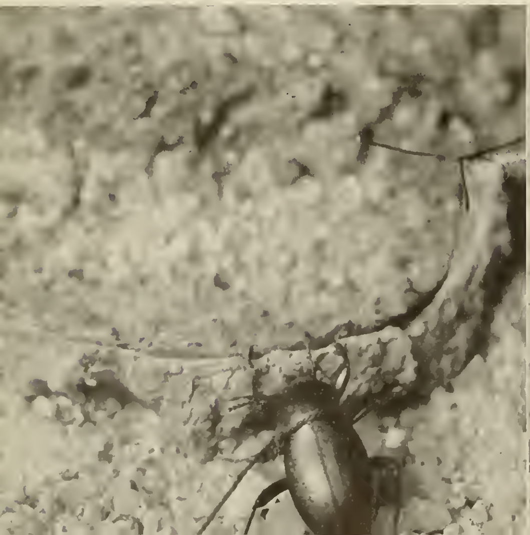
All photographs by the author

ONE of the accounts of the common trapdoor spider of southern California (*Bothriocyrtum californicum*) states that it can hold its door closed against a pull as great as ten pounds. This estimate has always seemed excessive to me, and as one of the spiders I had under observation was a vigorous "holder-downer," I decided to try measuring and recording the force.

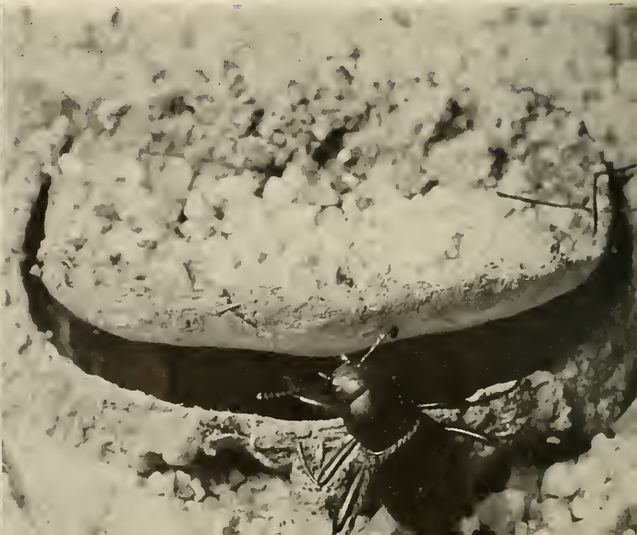
The high speed photographic flash developed by Professor H. E. Edgerton of Massachusetts Institute of Technology is a remarkable instrument for taking extremely rapid pictures of small creatures at close range. It was with this sort of apparatus that I was able to take the photographs reproduced here. They show not only the measurement of the spider's strength but also its actions in emerging from its trap door, seizing a beetle, and disappearing with it underground. Exposures as short as 1/30,000 second are possible with the high speed flash. The light has high actinic value, so that, when used close to the subject, the lens may be stopped down to f:22 or f:32, thus giving the greatest possible depth of focus. The high speed flash I used was a homemade prewar affair that involved an outlay of a little over $50.00.

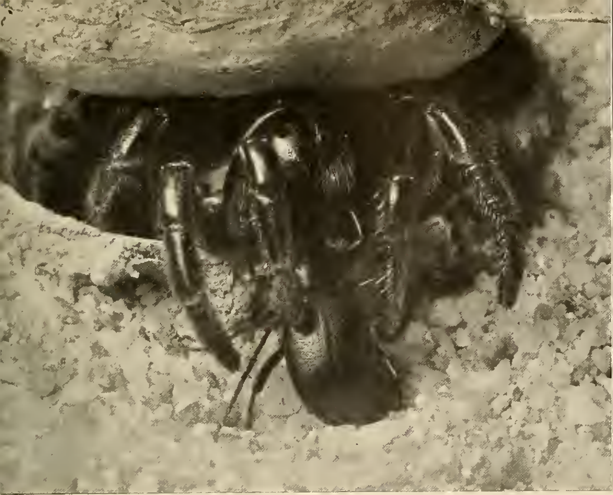
Two wires that can be seen in the first picture were arranged to make a contact and set off the light the instant the spider opened the trap door the right amount. Since

▼ A beetle has been placed near the door built by the trapdoor spider. When the spider opens the door, contact will be made with the wires visible at upper right and the super-speed flash will be set off, taking the picture. The actual width of the door is 1¼ inches

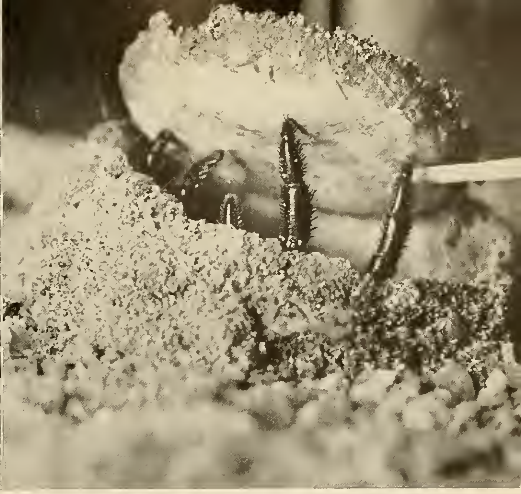


▼ The spider within its lair is just opening the trap door





▲**Here** the super-speed camera catches the spider in the act of seizing the beetle



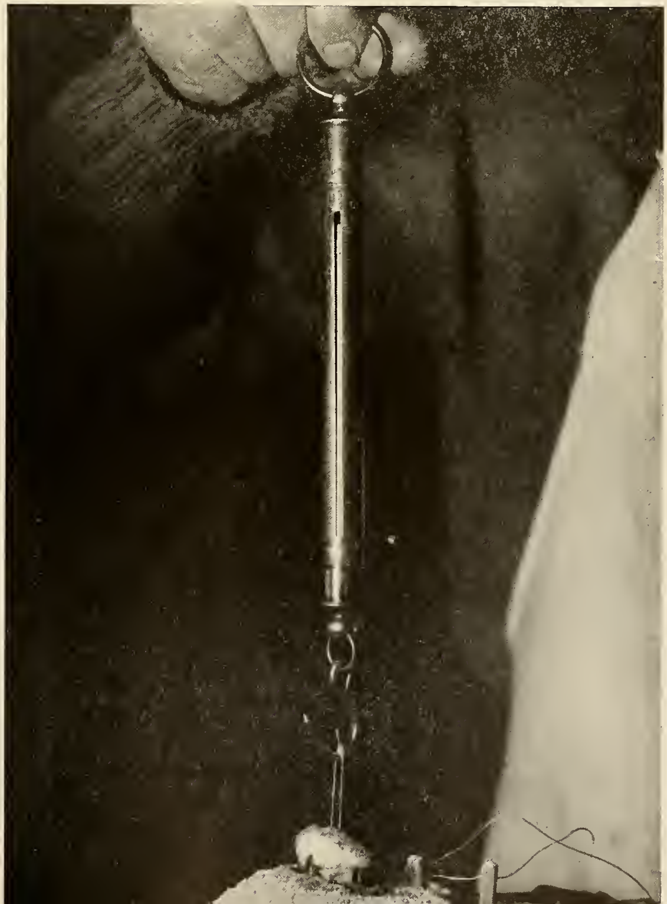
▲ **If the trap door** is lifted with a sliver of wood, the spider comes up to pull it down

the spider is mainly nocturnal in habit, the problem was simple. The shutter of the camera could remain open any reasonable length of time without spoiling the film, and the flash could be regulated to occur at any desired instant. The spider, a female, really took her own portrait.

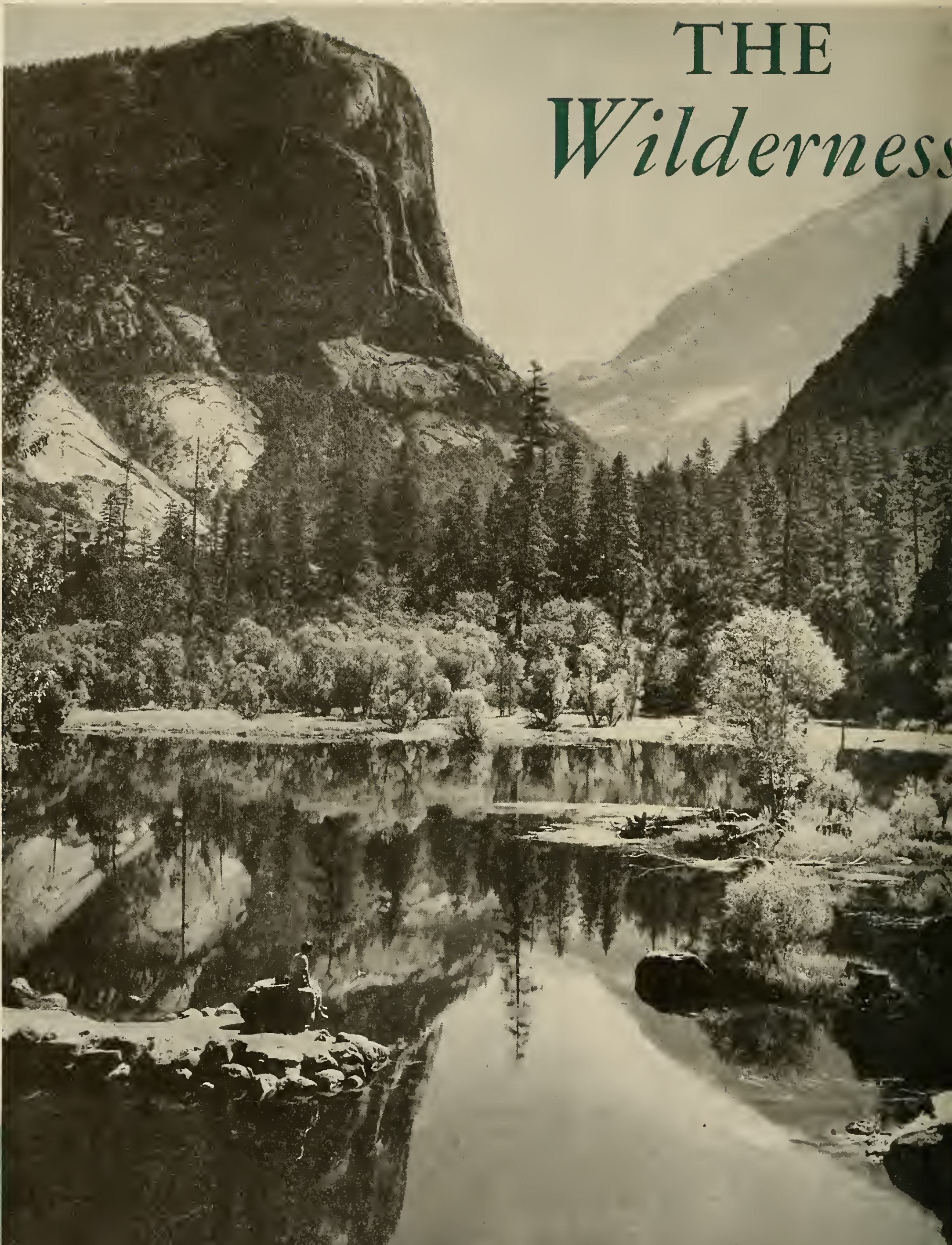
The next to the last photograph shows her pulling the door shut against the resistance offered by a sliver of wood. It can be seen that she grasps the door around its circumference with the tarsal claws, evidently wedging her body and cephalothorax across the passageway to furnish anchorage. To measure her strength, I drilled two holes in the door and threaded through them a loop of string. The fine wires making the switch were fixed so that the camera and flash would be set off when the door was lifted about an eighth of an inch, this being just before the moment at which experience indicated the spider would let go. Then the door was lifted with the spring scales and the pull recorded.

A force of fourteen ounces was indicated,—nothing like the reputed ten pounds, but a good strong pull, just the same. As the spider weighs about one-tenth of an ounce, the force is 140 times the spider's own weight. For a 150-pound man, the equivalent would be 21,000 pounds, or over 10 tons!

▼ **The pull** exerted by the spider measures 14 ounces, the equivalent of a 150-pound man pulling 10 tons



THE
Wilderness



John Muir and other conservation-minded individuals worked hard to preserve at least part of the wilderness for the people. It is up to the public to see to it that the national parks are not destroyed by commercial interests

belongs to the People

By CATHERINE AND DICK FREEMAN

"CLIMB the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness unto you, and the storms their energy, and care will drop from you like autumn leaves." These words of John Muir, the great conservationist, are as true today as yesterday. Tired and war-weary people may now, in the words of Muir, find that "going to the mountains is going home: that wilderness is a necessity."

In 1868 John Muir came to California by way of Panama, and almost immediately set out on foot to the great Yosemite Valley of which he had heard. Here he made his home for the next five years, gaining strength, energy, and unending joy from his close association with nature. To his careful and painstaking studies we owe our knowledge of the part that glaciers played in carving out the great U-shaped valleys, such as Yosemite. The mountains were to Muir a great book, whose pages he was driven on to read by a consuming desire. He was equally at home on the great glaciers, in their deep crevasses, and on the soft cover under the giant Sequoias.

Up to the time of John Muir very little had been thought of the necessity of preserving the wilderness areas. There had been so much wilderness that fear of losing it had been far from most people's minds. As a result, logging operations and extensive herding of cattle, and especially sheep, were beginning to take their toll, and to people like John Muir the possibilities of these unrestrained activities were most alarming. His whole soul burned with an unquenchable fire to fight for and save his beloved mountains.

In 1889 he met Robert Underwood Johnson, associate editor of *Century* Magazine, and talked with him of the tragedy of destruction in the vast Sierra and the desperate need for saving it. Johnson was much moved and proposed that he and Muir work together for federal control of the Yosemite area. In August and September of 1890 two articles by John Muir appeared in the *Century*, and in spite of much opposition and calumny, the National Park plan was successful. Not only was Yosemite

➤ LOOKING southwest from the summit of Mt. Conness toward Ragged Peak (center), with Young Lake at its foot

MOUNT WATKINS casts its reflection in the ol waters of Mirror Lake, in Yosemite Valley

◄ A TWISTED AND GNARLED OLD JUNIPER, on the north slope of Ragged Peak, that finally gave up in its battle against nature and the elements

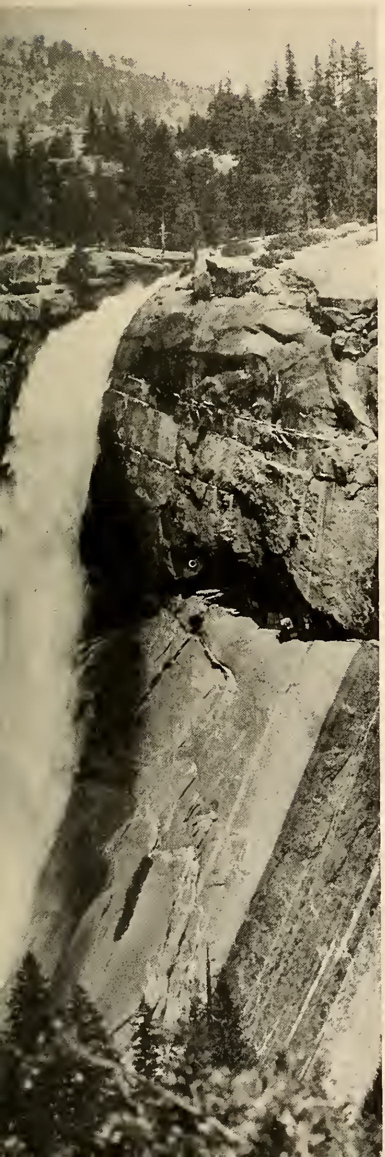
▼ (*Left, below*) YOSEMITE FALLS. The upper falls make a drop of 1430 feet. When the falls are low the wind sometimes flings light columns of water into fantastic shapes and occasionally blows the entire fall back over the cliff

▼ ONE OF MUIR'S FAVORITE TRAILS led past Nevada Fall in Yosemite Valley. When the Merced River runs high, a fall of water unequalled in grandeur can be witnessed. Muir called it "the whitest of all the falls in the valley, and altogether one of the most wonderful in the world"

National Park established, but General Grant and Sequoia as well.

But Muir knew that the establishment of the parks was but the first step in preservation. As he himself said, "No sooner were the boundaries of Yosemite National Park established, than interested parties began to try to break through them." A cavalry patrol was sent in by the Federal Government to protect the area, and constant vigilance was required to prevent poachers from bringing in their herds to the old feeding grounds.

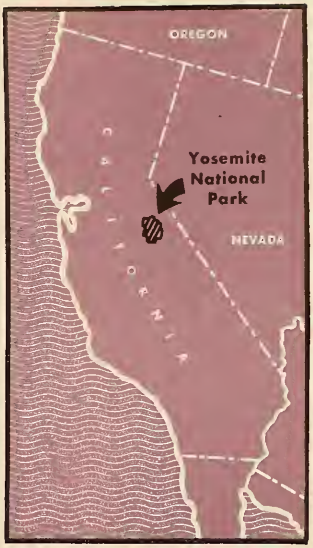
Thus John Muir did much to curb commercial exploitation of lands that the people of the United States want to preserve because of their recreational and educational value. But he knew also that the public, if it wished to retain what had been gained thus far, must never lose interest in these wilderness areas.



Less than a month after Theodore Roosevelt became President of the United States he sent for the facts concerning forest preservation from John Muir; and in 1903 he came to Yosemite to visit Muir and to camp with him beneath the stars and forest giants of Wawona. On the second morning, back of Glacier Point, they awoke to find a fall of snow four inches deep. On the last night, instead of attending a large banquet prepared in Yosemite Valley for him, Roosevelt went out again with Muir to sleep in the shadow of mighty El Capitan.

That Muir succeeded in convincing the President of the great need for forest preservation was shown by the fact that following his visit five new National Parks were established, as well as ten National Monuments.

Some time prior to this, Muir had gained a small group of earnest assistants in his work for conservation. A few ardent lovers of the wilderness had gotten together in San Francisco, and on June 4, 1892, had incorporated as the Sierra Club of California, with John Muir as president. Up to this time, Muir had fought with his back against the granite walls of the Sierra. Now he was to have dependable aid. Written into the bylaws of the club were the principles for which he stood. The purposes to which the club dedicated itself were: "to explore, enjoy, and render accessible the mountain regions of the Pacific Coast; to publish authentic information concerning them,—enlisting the support and cooperation of the people and the government in preserving the forests and other natural features of the Sierra Nevada Mountains."



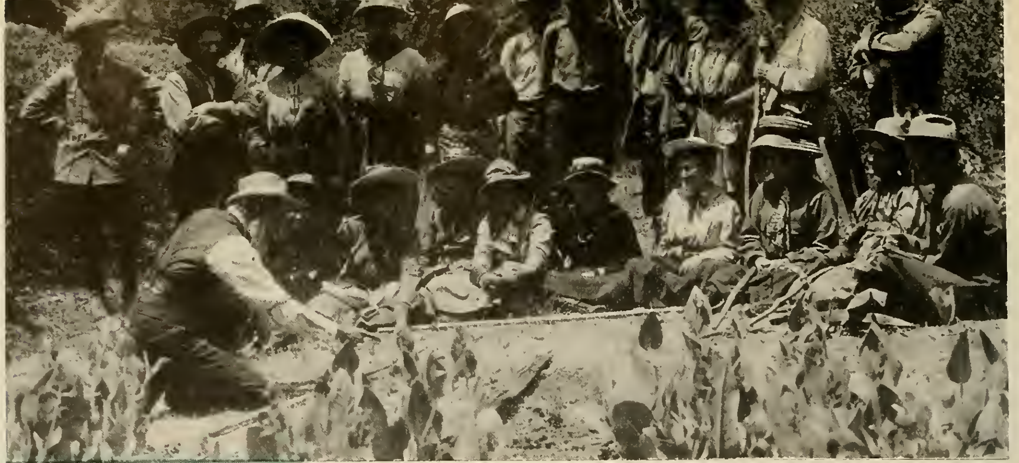
In the very first year of its life, the club began to prove Muir's confidence in it by taking action against the Caminetti Bill, which proposed reducing the boundaries of Yosemite National Park. The club also protested the illegal cutting of timber in the National Parks and fought long and constantly to have Yosemite Valley ceded back to the National Government and included within the park boundaries. The final acceptance of this bill was assured by Theodore Roosevelt's signature upon it June 11, 1906. At another time, the famous Devil's Post Pile was saved by the efforts of the club from being dynamited into blocks to be used as a dam across the San Joaquin River.

With the advice and help of the club many trails in the high mountains have been built, especially notable being the John Muir Trail, which traverses the length of the Sierra from Tuolumne Meadows to Mount Whitney.

Every summer in peace times many ardent devotees turn to the high mountains to spend several weeks in the heart of the mighty Sierra, hiking, fishing, studying the wildlife, painting and sketching, or just enjoying a trip on foot through the vast primeval forests of the great Sierra hinterlands. Following the John Muir Trail and its many branches, these people gain new strength and vision for their work. To the man who said, "I care to live only to entice people to look at nature's loveliness," this pilgrimage of recent years could give only the greatest delight.

Lasting protection

When John Muir was preaching that the wilderness belongs to the people, he did not mean merely the few hundred yards that are visible on each side of the roadway. Yet today this is the only place where large timber is found in some areas that



➤ MEMBERS of the Sierra Club listening to a lecture by John Muir, kneeling at left. (From a picture taken in the early 1900's by Clarence King)

have been stripped of their forests. Those who might think that National Parks just grow and need no watching should realize that Yosemite National Park has been cut by nearly a third, and that many billion feet of lumber have been cut from lands that were all or nearly all within the original limits of the park. In 1930, largely through the generosity of John D. Rockefeller, Jr., who put up about a million and a half dollars to be matched by funds from the National Government, a tract of about 12,000 acres was added along the western boundary of Yosemite National Park. In 1940 another purchase of 8,000 acres completed the inclusion in the park of probably the finest stand of sugar pine forest remaining in the State of California. This eliminates a large number of privately owned holdings within the park, which have been the principal cause of lumbering within park areas.

These two purchases were achieved only after long and bitter fights by such men as Stephen T. Mather, Secretary Harold L. Ickes, and others who were aware of what is going on

➤ ROYAL ARCHES, North Dome, Washington Column. The second of the two cabins occupied by Muir while in Yosemite was located near the base of these granite arches

◄ THE COW PARSNIP is one of the Yosemite Valley's best loved flowers. Half Dome, called "old Tissiack" by John Muir, forms the backdrop

➤ A SPRAY of azalea blossoms in the Yosemite Valley area

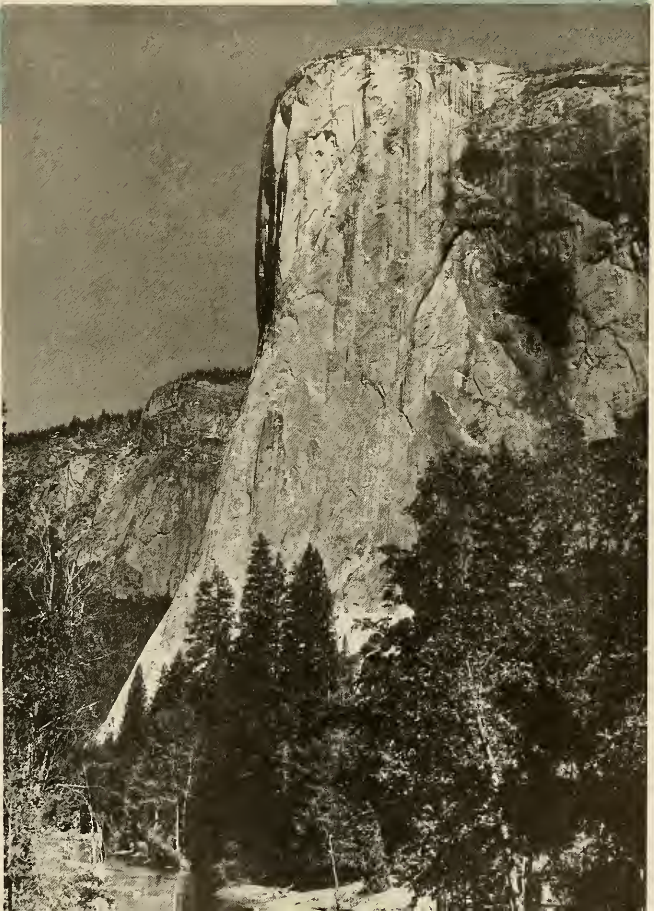
▲ Sierra Club hikers, resting above timber line after a 2000-foot climb out of the canyon below, on their way to the top of Mount Conness

in the wilderness areas. It remains the responsibility of the public at large to know the facts. Those who are interested in its commercial interests do.

Today we may all go by good roads to these wonderful areas called National Parks. Especially in these postwar times will these "fountains of life" give new strength, hope, and health to those who seek their freshness and beauty.

In the early days of Yosemite, before National Park times, wild animals kept far away from the haunts of man. Guns were commonly carried, and a wild animal was shot on sight. All kinds of animal traps were

➤ El Capitan, Yosemite's mighty monolith, is a 3000-foot wall of shining granite. It was near here that Theodore Roosevelt camped out with John Muir



▲ **John Muir** was described by Alex McAdie as "a great advocate for the preservation of the wild and beautiful," who "gave the best that was in him to the service of men" (Copied from a photo by Clarence King)

◂ **Middle Young Lake** with its boulder-strewn shores, against a background of the Sierra Nevada

common and were found on the floor of the valley as late as 1906. In fact, it is said that it took several years after this for the animals to realize that they were safe in the valley. Then they began reappearing, to become a constant source of amusement for the visitors who, indeed, have done far too much to spoil and make beggars of them.

In the Yosemite and other National Parks in peace times all can wander the forest trails with well-informed rangers, who help everyone to know better the animals, plants, and geology of the region. These men are all experts in their own line, and do much to make a trip to our National Parks enjoyable. At the museums established by the Park Service at all points of interest in the reserves, can be seen specimens of plants, animals, and rocks, together with historical sketches and photographs.

In some of the parks, notably Yellowstone, are special inducements to encourage visitors to travel the forest trails. Pamphlets are published and given to the public telling of places of particular interest and explaining how to get to them. Wayside information boards describe the local attractions, as, for example, a colony of beavers that the visitor can watch at their work in a stream. It is to be hoped that such features can be offered more extensively in Yosemite and other parks.

In these ways the purposes of the National Park system are well carried out. Stephen T. Mather, who gave much of himself to further park objectives, states these purposes clearly: "It is the destiny of the national parks, if wisely controlled, to become the public laboratories of nature study for the nation. We may expect that year by year these parks will become a more precious possession of the people, holding them to further discovery of America and making them still prouder of its resources, esthetic as well as material."

In the effort to become acquainted with nature, it is of course always possible that people will "civilize" the wilderness. With man, naturally, come hotels, lodgings, stores, camps, places of entertainment, and other like arrangements for comfort and pleasure. The fundamental rule for the protection of nature is, of course, to let nature alone. It is necessary, if man is to enjoy the great out-of-doors, to modify this concept, in as far as is reasonable, but the danger always remains. Man's encroachments on nature must be held within reason, or he will defeat his own desires. For these splendid purposes, National Parks were established, and their existence can be justified only on such a basis. If we fail to make the most of this grand heritage that nature has left us, nature will take away by her own careful processes what it has taken so much effort and so many years to gain.

This difficulty would in part be solved if visitors to the parks would spread out and not over-visit one particular spot, such as Yosemite Valley. There are vast hinterlands in the upper mountains, such as Tuolumne Meadows and above. The hardier souls could find much joy in putting a pack on their backs and tracking into the virgin wilderness away from automobile roads.

If one does not wish to carry a pack, a mule or burro can be procured, and the trip made in comparative ease—if you can handle the burro. This gentle art can be learned, of course, and traveling in this way does insure much greater ease to the hiker. Or if one goes in a group, a packer may be hired to take the luggage. In any case it is glorious to get back into the unspoiled areas where no tin cans, papers, and other evidences of a careless population greet the eye. If the animals there are not as tame, the beauty of the natural flower gardens and the quiet of the vast distances more than make up for it. There one can make his bed under a dome sprinkled with stars and know that his sleep will not be disturbed until dawn breaks with the songs of birds amidst the murmurs of a mountain stream. Treading the paths of the primeval wilderness brings a new energy to meet the problems of daily life and lifts one out of the petty aspects of routine into a broader and better concept of life.

Following the devastation of this war it is to be hoped that mankind, and Americans in particular, will throw off the load of materialism and sordid worldliness and seek beauty and new hope in the vast cathedrals of nature.

"Ho, come to the Sierra forests," calls John Muir. "The King is waiting for you—King Sequoia! There is life and health in his very looks, in the air he breathes, in the birds he keeps, . . . Come to the woods for here is rest."

▼ PACK TRAINS like this may be seen in the spring, summer, and early fall almost anywhere along the trails in the high Sierra hauling the equipment of camping enthusiasts

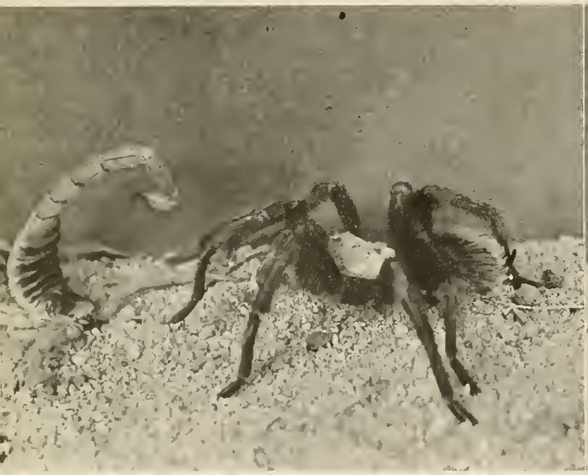
The TRUTH about SCO

IT is true that a scorpion has no backbone, but if you should have the misfortune to step on one while wandering about without your shoes, you would be willing to believe that an animal does not need a vertebral column in order to fight back. A friend of mine who operates a large cattle ranch in the foothills of the Santa Catalina Mountains near Tucson, Arizona, had just such an experience one night last summer. While crossing his living room floor, barefooted, he suddenly felt a sharp pain in his foot. Quickly switching on the lights, he discovered that a scorpion some two inches in length had, as he put it, "nailed him." The creature lay dead upon the floor, but it had succeeded in repaying its slayer before pressure of the man's foot had taken its life.

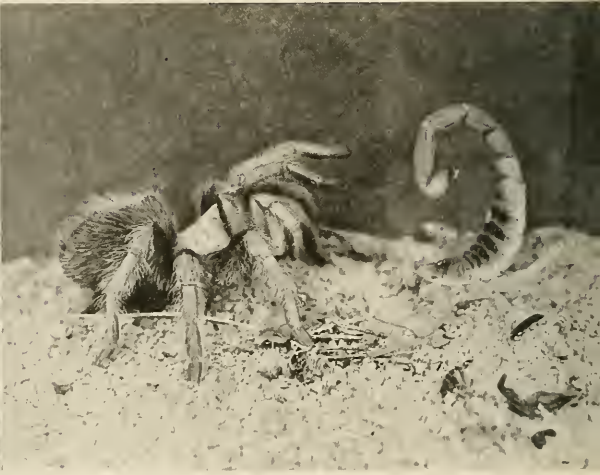
To the rancher's surprise there was no mark to show where he had been stung, and no swelling came at the point of contact. He went to bed but found it impossible to sleep. He arose a number of times during the night and was alarmed to learn that the poison had affected his optic nerves so that it was difficult to see any object distinctly. He also experienced distressing pains in the region of the chest. From the symptoms, it was certain that he had been stung by one of the two most harmful kinds of scorpions known in America. Regardless of a restless and uncomfortable night, he somehow managed to carry on his strenuous work the next day, riding far out on the range and actually roping several calves.

In three days he felt nearly normal, and the scorpion sting, though still a bit annoying, did not cause him any further marked trouble. "It's a strange thing," he said, "but nobody seems to know very much about scorpions. Once in a while someone gets stung or sees one and kills it, but still we don't know about 'em. There are different kinds, too, and I guess they live in a good many states."

Some persons who have had encounters with the dangerous species of scorpions have not been as fortunate as the rancher. More than 40 authentically recorded deaths have been reported in Arizona in the last ten years. In all instances, children have been the victims. Many adults have been hospitalized. Regardless of this, scorpions have never been known to go out of their way to injure a human. They journey about at night in search of food, mostly spiders and insects. The scorpion seizes its prey with its lobster-like pincers and either subdues it through the "squeeze" system or poisons it by means of



a ENCOUNTER between a Giant Hairy Scorpion and a tarantula. The scorpion arches its back and brings its stinging apparatus into readiness as the tarantula approaches



b BOTH have moved to a new area, and the tarantula is again drawing near. The scorpion holds firm with its rear legs and raises its weapon. It has struck the spider once

By William H. Carr

Photographs by Marvin H. Frost unless otherwise credited

PIONS

Intimate facts about creatures that have been shunned since Biblical times

the needle-sharp stinger or spine at the very tip of its body.

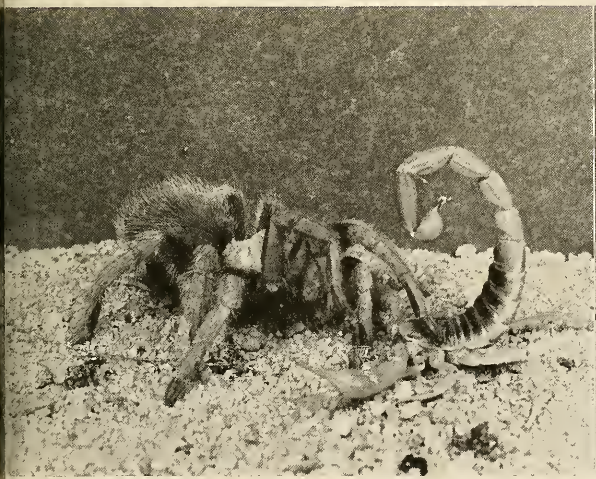
The business end of scorpions may be operated either in self-protection or in offensive action, with lightning-like rapidity or slowly and deliberately as the occasion demands. The curved spine projecting from a bulbous base, is brought up over the scorpion's back to strike, unerringly, any insect or other prey held firmly in the pincers. It is not correct to say that the puncturing device is located on the end of the "tail," because the alimentary canal continues right to the base of the poison-injecting apparatus. In effect, scorpions have no tails. The venom is developed in two glands just below the stinger. Thanks to the fact that the long, thin, stinger-tipped section of the body is jointed in more or less ball-and-socket fashion, the scorpion is able to turn its weapon in practically any direction and thus strike within a wide radius.

Scorpions are not insects. Among other differences they possess eight legs while true insects have only six. They are close relatives of the spiders, belonging to the same scientific "class." They breathe by means of small, whitish lung sacs, which you can see if you care to examine the under surface of the scorpion. Incidentally, when one of these creatures is turned upon its back it rights itself within a split second.

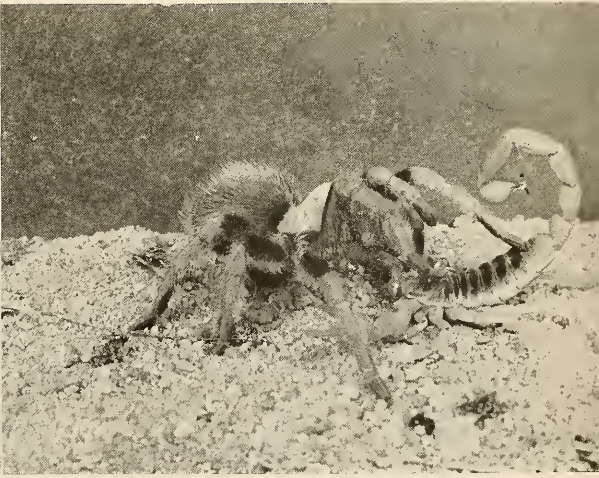
The ferocity of scorpions has been very much exaggerated, as has been that of most animals possessing poison in any degree. The creature's principal effort, whenever approached, is to run off and hide as speedily as possible, waving its efficient pincers in an effort to ascertain the nature of its aggressor. In fact, it sometimes fails to use its poison attachment even when cornered. It is wise to shake off a scorpion that may accidentally fall or otherwise land upon one's person. If one's hand is brought down upon it or if it is too rudely brushed aside, it is very apt to retaliate, with unfortunate results.

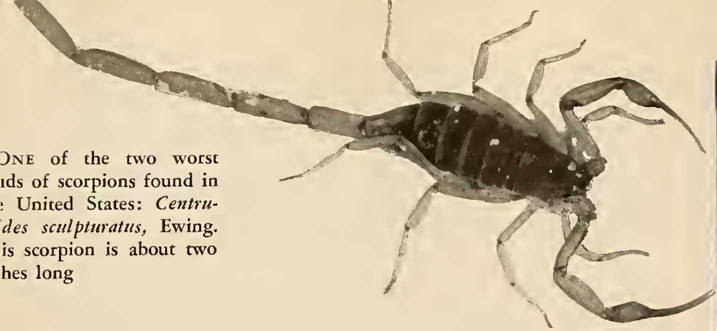
I once observed a scorpion that had grasped the leg of an exploring tarantula. When the large spider endeavored to pull away, the smaller creature released its grip, not once employing its stinger during the encounter. Scorpions possess from 2 to 12 eyes, yet their sight is so poor that about all they are able to distinguish is the difference between light and dark. The pincers are used as "feelers." Scorpions traveling about, undisturbed, remind one of a blind person groping in the dark with arms outstretched to avoid and identify objects in the path.

c The tarantula now closes in. It has been struck several times by the scorpion, apparently with no ill effect. Note the piece of spider "hair" remaining on the stinger

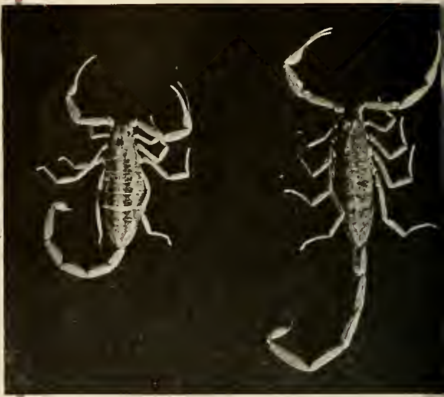


d The tarantula tried to bite the scorpion but caused no damage. Neither creature showed signs of injury after the encounter, and both were alive more than three months later





ONE of the two worst
nds of scorpions found in
United States: *Centru-*
des sculpturatus, Ewing.
is scorpion is about two
hes long

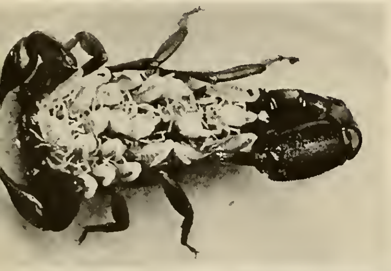


➤ THE OTHER of our two most dangerous scorpions, male and female: *Centruroides gertschi.* The 40 or more other scorpions are considerably less poisonous

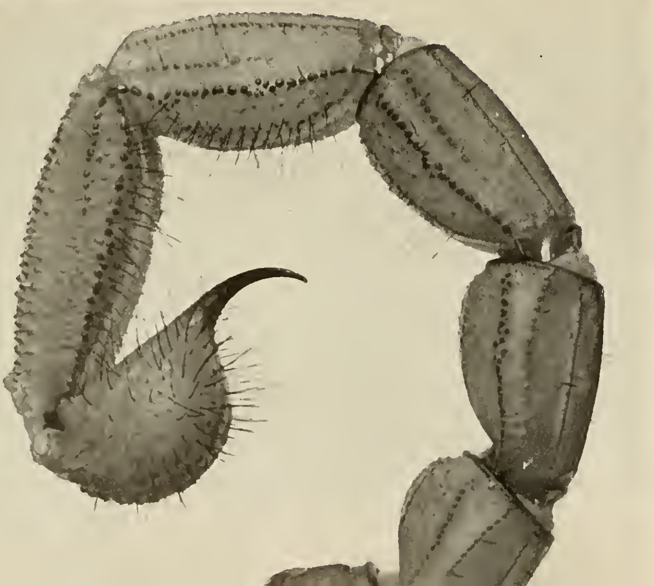
Photo by Herbert L. Stahnke

EWBORN SCORPIONS clinging to the mother's back. Popular super-
on has it that young scorpions feed upon the tissues of the
ner, but this is not so. The sting of this scorpion, *Vejovis spini-*
s Wood, is said to be no more dangerous than that of a wasp

by Herbert L. Stahnke



⮟ NOT a cactus plant but the jointed hind portion of a Giant Hairy Scorpion, showing the stinger projecting from its bulbous base



In order to sense the nature of its surroundings and objects over which it may pass, the scorpion also uses small, comb-edged projections, located upon the lower surface of its body. This auxiliary tactile equipment is kept in constant motion as the creature progresses over the ground.

Scorpions exist the world around in warmer climates. More than 600 species are known. In our own country they are found particularly in the southern states from coast to coast. Various kinds are found in 30 of our states, ranging in size from less than an inch to some eight inches in length. In general, the northern limit of scorpions in the United States roughly follows the southernmost advance of the ice sheet during the last glacial period. None have thus far been reported from New England.

Of the more than 40 known species of scorpions in the United States only two are of any serious danger to mankind. These two varieties have caused numerous fatalities among children, since the early days when the first pioneers entered the regions of cactus and thorn, for the particularly venomous species live in Arizona, California, and possibly Texas. They are known, scientifically (and jawbreakingly) as *Centruroides sculpturatus* and *Centruroides gertschi.* No acceptable popular name has been adopted for these dangerous scorpions. As one scientist remarked, "They just never will be popular anyway!"

Both varieties are rather innocent in appearance, in striking contrast to some of the larger, more startling-looking types. They are slender and grow to a length of about two inches. The one known as *gertschi* possesses black stripes running down its straw-colored or yellowish back, while *sculpturatus* lacks this patterned decoration. Both scorpions may be darker in ground color depending upon age or other natural causes of discoloration. Their identification is not easy for the layman.

Unfortunately they live in close proximity to man, hiding in the daytime beneath boards, stones, bricks, rags, or rubbish, especially where a bit of dampness exists. The creatures have been known to seek the protection of sheets and blankets upon beds, a highly unwelcome trait. It is well to remember that scorpions that burrow in the sand are not of the lethal kind.

Dr. Herbert L. Stahnke, a specialist in poisonous animal research in the State College at Tempe, Arizona, has devoted many years to

▲ A TYPICAL EXPLORATORY POSE: the Giant Hairy Scorpion, *Hadrurus arizonensis* Ewing, approaching the top of a rock, with pincers reaching forward. Scorpions have poor eyesight

▼ HEAD-ON VIEW, showing the mouth parts of the Giant Hairy Scorpion, located between the two pincers

the study of scorpions, with the aim of learning their behavior and discovering means of combatting their poison. He points out that the sting of the two dangerous species of scorpions may cause death in from 45 minutes to eleven hours, and the suffering meanwhile is considerable. The venom of *sculpturatus* and *gertschi* produces a reaction upon the nerves, an effect that is general in character. The stings of the more innocuous types, on the contrary, result in local inflammation and swelling, somewhat like a wasp or bee sting. With this fact in mind it is well to recall that the more harmful injection of poison does not result in swelling or discoloration in the area first affected.

Recoveries among children are numerous, and fatalities among adults are extremely rare. Dr. Stahnke advocates an ice water treatment for the limbs, or crushed ice packing for body stings, the idea being to localize the venom as much as possible. It is also advised that a tourniquet or stricture be applied immediately to prevent circulation for a brief time and isolate the venom. The tourniquet should be released within five minutes and not replaced. Under no condition should hot packs be used. Patients who have had the latter treatment have survived in spite of it—not because of it. Heat causes the poison to spread rapidly, whereas cold delays it. Children should have medical aid at once, the ice or ice water treatments being continued meanwhile, despite any inconvenience or discomfort caused by the cold.

The Mexican Department of Public Health developed a serum to offset the harm caused by the venom of scorpions. Dr. Stahnke secured a small amount of this life-saving liquid in 1935 and found it quite effective. However, he learned that there were too many legal difficulties surrounding the transportation of the serum across the Mexican border. Furthermore, it could not be secured in any appreciable quantity. Consequently, he commenced research of his own to produce an American serum to combat the damage to nerve tissues caused by scorpion venom. Although the work is still in the experimental stage, Dr. Stahnke is confident that the date of the manufacture of new serum is not far off. The Arizona State Legislature was requested to furnish funds to further this research. Two mothers, whose children had been killed by scorpion stings, appeared before the lawmakers to testify concerning the need of an adequate serum to prevent similar tragedies. Substantial appropriations were forthcoming, and the scientists are hard at work.

In an effort to become better acquainted with scorpions I have kept some five different species in roomy glass cases in my home. Their marvelous adaptation to their peculiar mode of existence is certainly noteworthy. One large individual proved especially tractable and repeatedly demonstrated his ability to act in public. He was about four inches in length and belonged to the less harmful group of scorpions. When touched with a wire or otherwise molested, he would seldom strike with his poison barb. Instead, he would try to sidestep the object, crablike, or else back away. While walking about he constantly waved his pincers and kept his stinger raised, arched and ready, with his body well off the ground. At times, when attempting to avoid the offending wire, he would behave like a sedate performer of the stately minuet.

His ability to dig was amusing as well as interesting. If a dog had eight legs, it would dig as this scorpion did. Using its pincers as a support in front and its hindmost pair of legs as a rear anchor, the creature would work in spurts, very rapidly, employing its forward legs, scooping up the sand at a great rate, and throwing it at least ten inches out between its hind legs. Finally a small mound of sand would accumulate, whereupon the scorpion would back up and literally kick the pile out of the way so it would not impede further digging operations. Speed and energy were the watchword as the nocturnal animal struggled to bury itself. Occasionally it would stop to clean its pincers, using its front legs in the process. Our scorpion was as smooth and glistening as could be—truly well-groomed. No doubt frequent burrowing in the sand would favor the creature's shining appearance. In addition, scorpions are known to use secretions from their mouths to aid in keeping their bodies clean.

Whenever the scorpion did bring its weapon into play, it would strike with such rapidity that one's eye could not follow the movement. The hind end would dart forward, bringing the barb into contact with the wire or stick, so swiftly that the action seemed over before it had started. After the creature had had an exciting bout with the long-stemmed tweezers that were used for handling it, it would relax and rest. At this time the stinger would be permitted to droop over to one side as the scorpion settled down upon the floor of the cage.

The life history of scorpions is imperfectly known, but much has been learned about their way of reproduction. Eggs are developed within the mother's body and hatch very quickly after they have been deposited. The female hovers over them meanwhile, maintaining actual contact until the thin membranes open, sometimes a matter of seconds, and the young climb upon her.

Contrary to popular belief, young scorpions do not feed upon their mother's body. They are endowed with a "yolklike" substance that supplies nourishment until they are able to fend for themselves. The strong plates upon the mother's back are much too resistant to be pierced by the relatively delicate mouth parts of her young. Bob Ripley, in his "Believe It or Not" column, once declared that the female scorpion was "the finest example of maternal sacrifice. She feeds her young with her own body." This, however, is not the case. No, the mother carries on quite well after the offspring have departed, unless overtaken by some

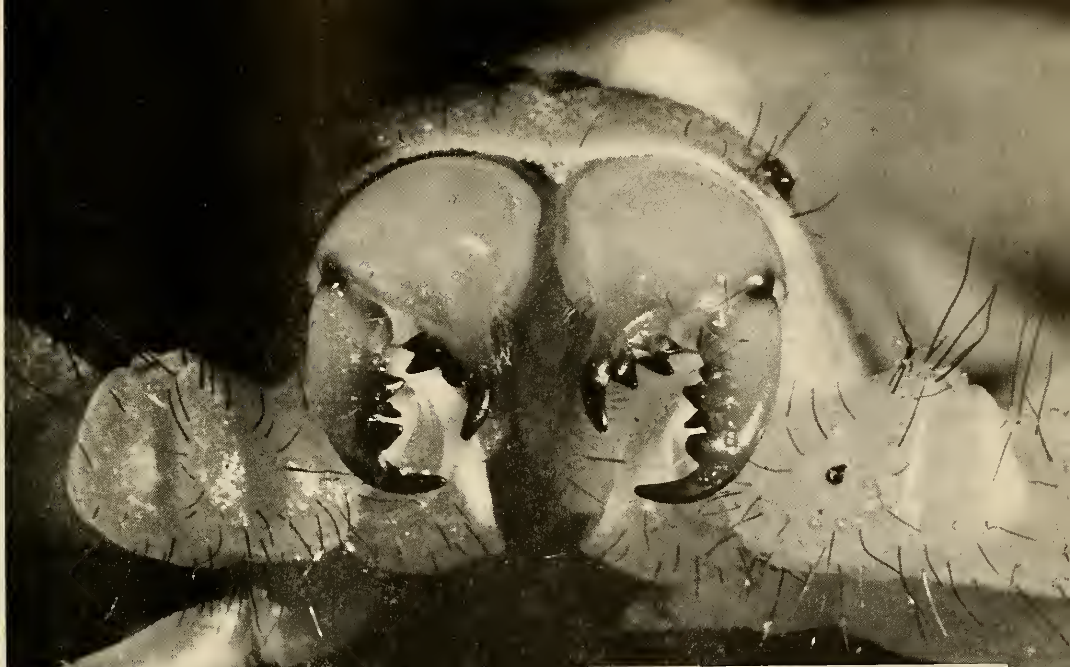
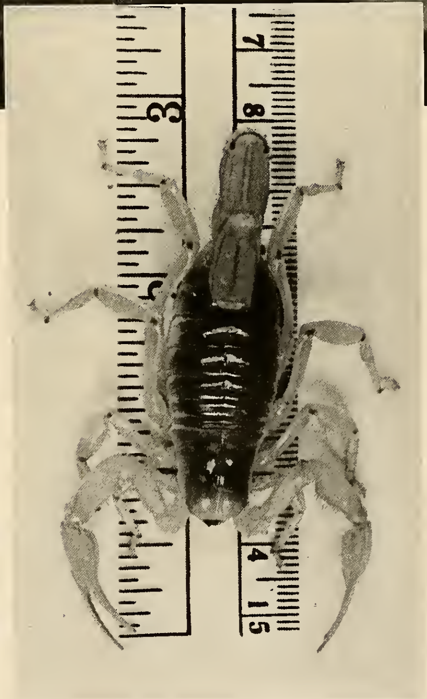
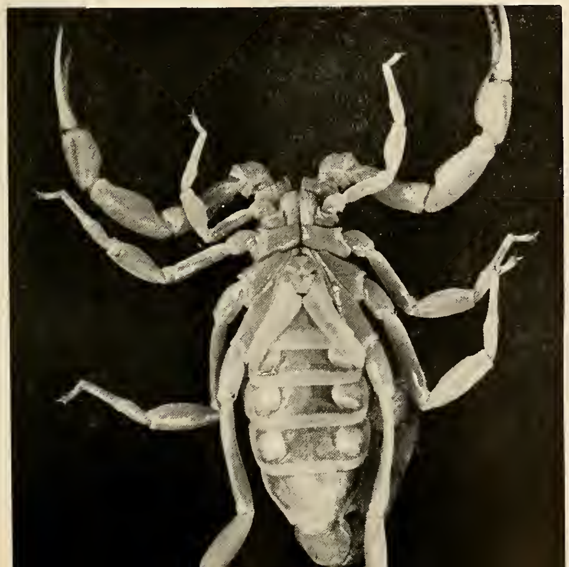


Photo by Richard L. Cassell

➤ A HIGHLY ENLARGED photograph of the mouth of the Giant Hairy Scorpion

➤ IF THE HIND PART of this Giant Hairy Scorpion were straightened out, the creature would measure about four inches in length. Some scorpions in the United States are approximately eight inches long, others less than an inch





◄ SMALL, comblike projections on the undersurface of the scorpion help it to sense the nature of the ground over which it is passing and are kept constantly in motion. Just behind these, the two rows of whitish lung sacs can be seen misfortune. The infants cast off their first skin or outer covering while they are still upon the mother's back, and this causes her to appear quite disheveled in the region where the young are, or have been, ensconced. No doubt this has caused some observers to believe that harm has come to her through the activities of her young. When departure takes place the little scorpions wander off by themselves and are fully able to become self-supporting.

Another fable has it that scorpions, when hard pressed, will sometimes commit hara-kiri by stinging themselves. There is one main fallacy in this conclusion, and that is that the creature's poison has not been observed to have any fatal effect upon it. It is quite possible that, when engaged in active combat or otherwise excited and striking viciously, the scorpion may accidentally receive a jab from its own barb.

My interest in the animal with the poison sting ultimately led me to visit Dr. Stahnke, who, in connection with his work as a leading authority on scorpions, is host to some 500 of his subjects. Many kinds of scorpions in bottles, jars, open-topped glass boxes, and test tubes are to be seen on the shelves and tables in the specialist's laboratory. The more harmful varieties are "milked" of their poison to provide a "venom bank," used in the production of serum. Dr. Stahnke has the distinction of having been the first to name twelve species of scorpions, and he is classifying several other unnamed kinds at present. Like all true enthusiasts and students, he proved very willing to share his knowledge, providing me with some previously little-known information for this account. Among other rare experiences, Dr. Stahnke has witnessed the mating of scorpions and the birth of the young.

He presented me with a fine, healthy pair of one of the two most harmful species of scorpions, the *sculpturatus* variety. The evening before, when I was helping a friend attack termites in a ravaged library, I had come upon another kind of scorpion in the wainscoting of the room. We had torn away the wood in an effort to expose the offending termites and, in the midst of our operations, the small scorpion appeared from inside the wall, only to be placed quickly in a bottle. We gave this specimen to Dr. Stahnke in exchange for his gift, and it proved to be a rather uncommon type, not of the excessively poisonous variety.

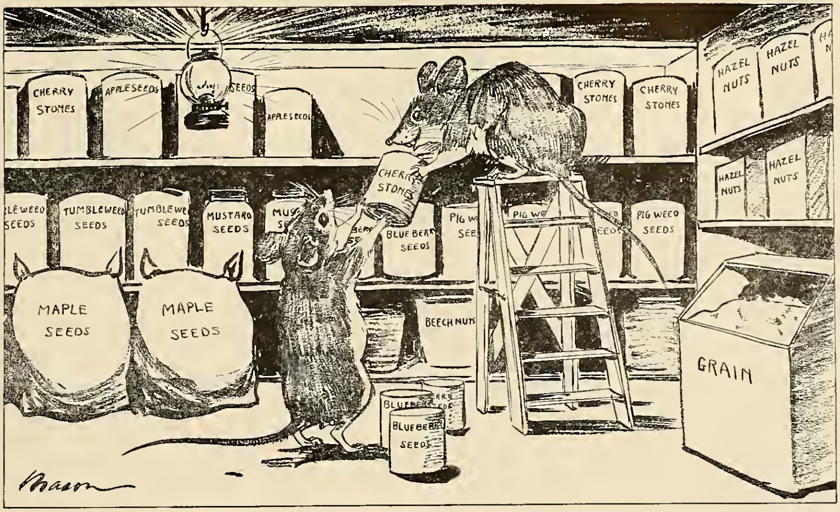
A large scorpion, kept previously for my own study, proved to be of the type known as the "Giant hairy scorpion." While its appearance was fierce, its sting was no more dangerous than that of a hornet. The much smaller *sculpturatus* did not appear half as dangerous, yet its sting was many times more virulent. While being transferred from one container to another, this dangerous scorpion proved exceedingly active, scrambling about and darting from one point to another in an effort to escape. When a damp cloth was placed in the jar these scorpions would cling to its undersurface in an upside-down position. Frequently I observed that *sculpturatus* curled the end of its body in such a manner that its poison spine actually touched its own body.

Despite the fact that scorpions have been despised and wholeheartedly shunned, they nevertheless have the singular distinction of having been selected to designate one of the great constellations of stars and to represent one of the signs of the zodiac, the symbol for the month of October. There are several references to scorpions in the Bible. They were named as one of the terrors of the wilderness of Sinai, where they still exist. More than ten species are known in Palestine. They were also believed to be a symbol of desolation and were depicted as divine scourges. Indeed, they sometimes were a tribulation in certain areas, yet it is amazing how few persons have taken the trouble to observe their ways.

A man with whom I come in almost daily contact has lived in a section of Arizona where scorpions are especially prevalent. His child had actually been stung twice by the most objectionable type of scorpion and had nearly succumbed, yet his knowledge of the animal was surprisingly scanty, and the information he did possess was a combination of folklore and faulty observation. He had believed that scorpions stung with their pincers and also that they deliberately sought out humans to sting. Dr. Stahnke has labored long and hard to inform persons about scorpions but is quick to say that a great deal remains to be done to provide the public with essential natural history information. It is almost as important to quell unnecessary fear as to engender a healthy respect for the creatures. It seems a pity that people's enjoyment of the out-of-doors is impaired through needless worry about the imagined dangers of animals large and small. Only through intelligent efforts can thousands who are uneasy in the open learn to be at home in the woods and deserts and gain an uninhibited appreciation of some of America's outstanding scenic marvels.

It should be a comfort to many that in the vast majority of our states scorpions are not of the virulent kind. By the same token, people who live in the restricted areas where *sculpturatus* and *gertschi* occur are grateful for knowledge of protection against, and treatment of, scorpion stings. Dr. Stahnke has learned, incidentally, that the newly-discovered chemical repellent "DDT" can be used very successfully in ridding dwellings of scorpions. He cautions against turning over boards and stones in infested regions and states that no one, "who uses his head" and observes a modicum of caution where caution is advisable, need fear scorpions during an outing anywhere in America. However, he does believe that being forewarned is a good preventive particularly where dangerous varieties of scorpions exist, for, as the Bible tells us, in Revelations 9:3, "the scorpions of the earth have power."

WHITE-FOOT'S HOARD



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

ONE summer several years ago someone brought me an old beer can. It had been opened with a can opener which cut a triangular hole approximately an inch long and slightly less wide, and it was filled almost to capacity with black cherry stones. Each of the cherry pits was empty, and the small holes, through which the meat had been removed, showed tiny grooves that had been made by the gnawing teeth of a white-footed mouse. This handsome wild creature had apparently found the can an ideal storehouse. The smallness of the opening kept out any larger animals that might have wanted to rob the mouse, and the weatherproof tin preserved the pits from moisture and from the moulds that grow in moist places and spoil pits and nuts.

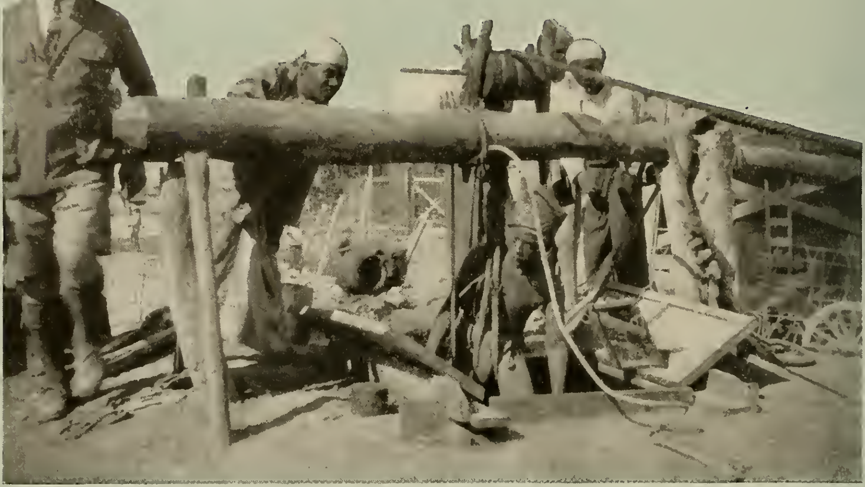
The white-footed mouse stores up many kinds of food for the winter, during which many supplies on which the mice depend in more clement times are no longer to be found. A pair of these animals was discovered in a nest, in the hollow trunk of a beech tree. In the space around the nest were about two gallons of beechnuts, most of them husked. Another family of white-footed mice laid up several quarts of cleaned clover seed in a stump located in a field of red clover. The white-foot, like many of its relatives, feeds on "meat" of various sorts, so it sometimes gathers the pupae of moths and stores them. These provide fresh animal food for the season when the mouse cannot otherwise obtain insects. While sometimes containing only one kind of food, these caches more often hold a mixture of edible seeds of many weeds, berries, and grasses, as well as pits and nuts. The seeds are usually cleaned and husked to remove unnecessary moisture and to speed the curing. The industry of the white-footed mice is quite astonishing. Once Dr. W. T. Hornaday found a nest in a hollow log, the home of five white-foots, near which was packed more than a pint of cleaned seed, probably from one of the mustards. Next morning it was found that the mice had transferred every grain of seed and every bit of nest material to a place under the seat of his buggy. He again removed nest and seed-pile and put them on the ground, but the mice once more carried the entire store back to the buggy seat and rebuilt their nest there. The mice could hardly have rested during those two nights.

The white-footed mice have convenient pockets, one in each cheek, which aid in carrying seeds and other foods. These are thin-walled sacs opening inside the mouth, very different from those of pocket gophers, pocket mice, and kangaroo rats, which open outside of the mouth and are fur-lined. Chipmunks, ground squirrels, and many of the Old World monkeys have these internal cheek pouches.

Other kinds of our native mice store food for the cold winter season. In the northern parts of the Great Plains a race of the common meadow mouse, or vole, is noted for its hoarding habits. In autumn the shaggy, short-tailed voles gather the ground nuts, fruits of the wild bean, tubers of the artichoke sunflower and the white rootstocks of the wild morning glory. A peck or more of these are often stored in a vole's burrow. This thrifty habit is quite remarkable, since most other kinds of meadow mice store little or no food for the winter, finding enough of their food under the snow. Knowing of these stores, the Indians of the Plains used to hunt for food caches of the meadow mice and depended on them for an important part of their winter supplies.

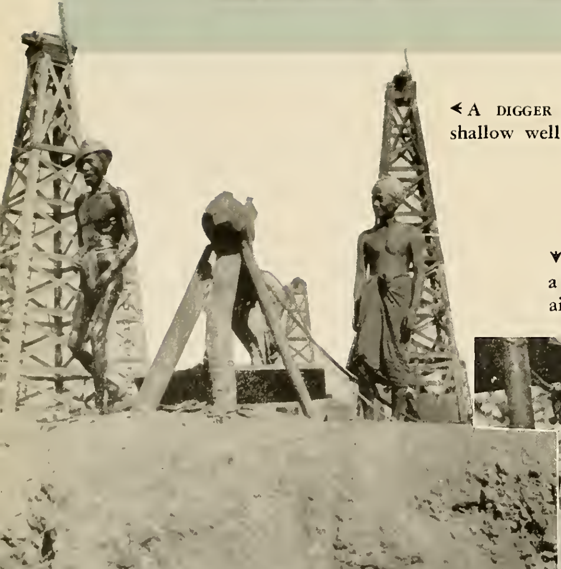
THE TWINZA

▼ A Burman digger is lowered into a shallow well where there is no gas. The mirror on the right is used to reflect light down to the worker

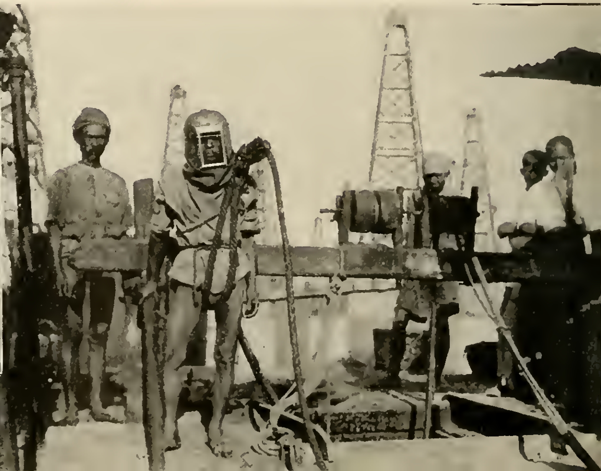


All photographs by Lilian Brown

◄ A digger emerges from a shallow well covered with oil



▼ The helmet of the native's "diving suit" is sometimes made from a gasoline can. The air tube is looped over the digger's body, and air is pumped to him by the men on the right



OIL WELLS

In the chief oil center of Burma, modern gushers and little hand-dug wells operate side by side

By Barnum Brown

Curator Emeritus of Fossil Reptiles, American Museum of Natural History

HALFWAY up the Irrawaddy River in the semidesert section of Burma lies the chief oil center of that country. Its maximum peak of production is past but it still averages around 14,000 barrels of oil daily.

It is a well-known axiom that wherever sheep can be grown profitably, there you will find Scotsmen. It is likewise true that wherever oil is produced, there you will find Americans, usually operating the field although in British territory Americans cannot own oil lands. And so it is at Yenangyaung (the creek of bad-smelling waters). Americans operate the field, and 1200 derricks in two great clusters stand like forests of huge trees, many of them only 60 feet apart with legs overlapping.

In the native village, Buddhist pagodas dominate the hilltops and bamboo houses straggle along irregular streets, but the scene in the adjacent oil field is a lively one. Autos tear along the road; derricks are enveloped in a haze of smoke; the smell of oil is in the air; and the throb of engines never ceases. It is a typical oil center that might just as well be Burke Burnett or any other familiar home field were it not for the primitive hand-dug wells, which are one of the unique sights of Burma.

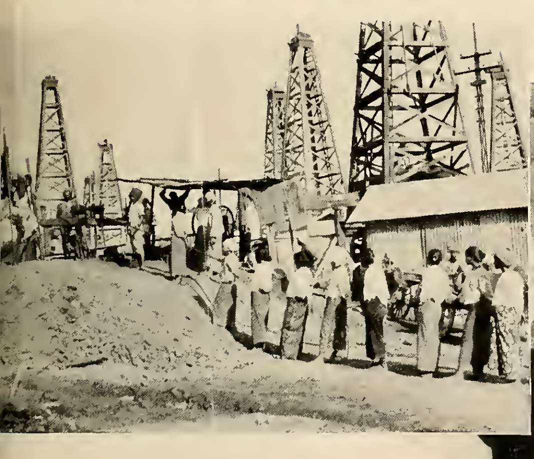
The Burmans discovered this field long ago, because there were places where the oil seeped out along the creek; and they had long known uses for oil. They burn it in rude lamps at their *pwes*, or theatrical performances, grease bullock carts with it, and soak the woodwork of their houses with it as a protection against "termites" (white ants).

In a library in Pekin there is said to be a diary of a Chinaman who visited Yenangyaung in the latter part of the thirteenth century in which he speaks of the oil industry there. Authentic records show that two tracts, Twingon and Beme, now the center of production, were worked by the Burmans at the end of the eighteenth century.

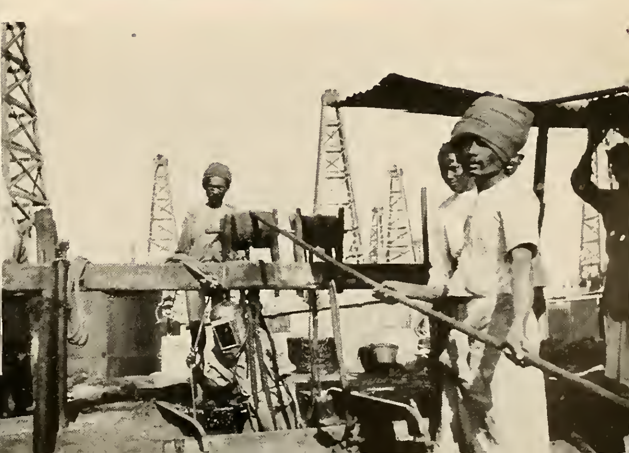
During the Burmese regime, the king granted to 24 heads of families the right in perpetuity to dig for oil. These families were known as *Twinzayos* (*twinza* meaning "one who obtains a livelihood by possessing an oil well"), and the hereditary ownership was passed on from male to male or from female to female. Thirty cubits, or about 45 feet, was the established distance between two adjacent wells, but later this distance was fixed at 60 feet. After the British Government annexed upper Burma in 1885, they recognized the rights of the Burmans, and the sale of such small tracts to competing companies has resulted in wells being so close together that frequently the legs of derricks overlap.

The Burman laboriously digs his oil well with crude tools and boards it up as the well is deepened. He descends 200 or 300 feet to the uppermost oil sand, but in some parts of the field the wells reach a depth of 400 feet. It takes him nearly two years to complete a 400-foot well—a depth that a modern driller would

▾ **BURMESE GIRLS** lowering a digger into a well



▾ **DIGGER** in "diving suit" descending into a deep well. One pulley is used for the man, the other for the oil and materials

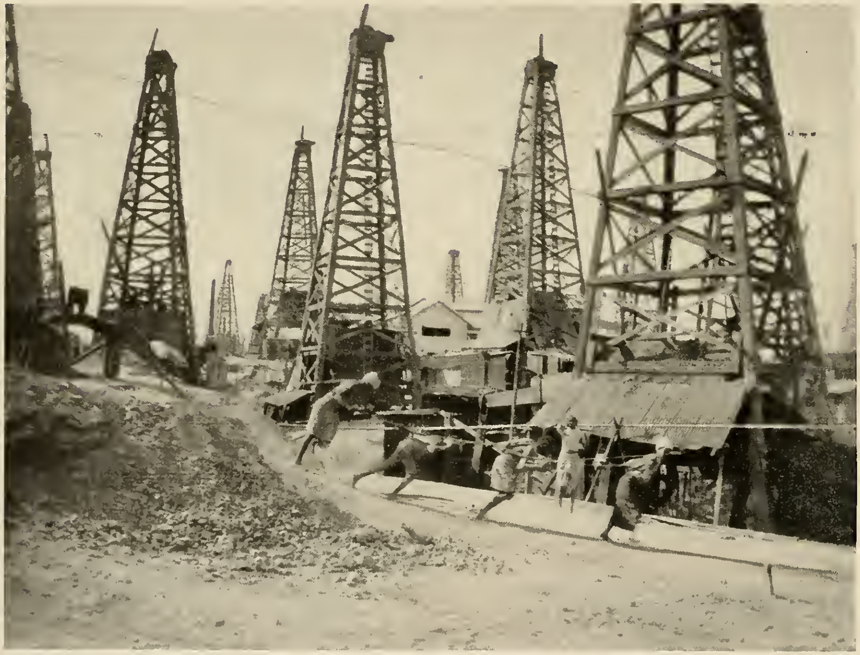


attain in less than a week. A rude frame with pulleys is erected over the hole and the digger is lowered on a rope by eight or ten coolie women. Formerly where a well was 250 feet deep, a man, practically nude, would be lowered, and it would require a quarter of a minute for him to reach bottom. He would dig frantically for half a minute in an atmosphere of gas. Then it would be necessary to haul him to the surface, and it would take half an hour for him to recover sufficiently to make another descent. He could not make more than 20 descents in a day.

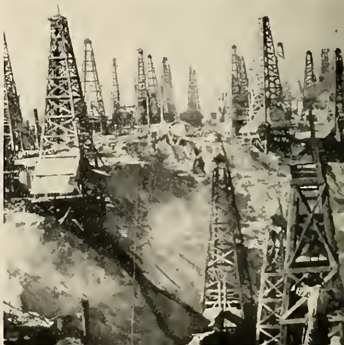
Since 1896, the natives have used an abbreviated diving suit with a headpiece made of a gasoline or kerosene can, to which an air tube is attached. Air is supplied to the man by two pumpers, usually members of the family. In this way, the man can stay at the bottom of the well an hour or more, even at a depth of 400 feet. Light is reflected down to the worker by a mirror resting at the top of the hole.

In this field, there are few sandstones or hard calcareous substances. When they do encounter hard rock, the Burmans have an ingenious way of breaking it. A cone-shaped mass of iron weighing about 150 pounds is suspended by a thin rope over the mouth of the hole. This iron is shifted until over the required spot, and the rope is cut. When it strikes bottom, the impact can be felt on the surface for a considerable distance. In a well 250

▼ Coolies pulling oil up from a deep well. If the digger works rapidly, a can of oil can be brought to the surface every seven minutes



Cans of oil from a hand-dug well being loaded onto a bullock cart



feet deep, the force of the impact would be 19,200 pounds, and one or two impacts are usually sufficient to break up the hardest rocks. Each time the weight is dropped, a man has to go down and attach a rope to it. Then he is drawn up, and afterwards the weight is brought to the surface.

In Yenangyaung there are about 60 of these *twinza* wells still operating, and the best of them produces from one to four barrels of oil per day. When they are producing, a man stays at the bottom of the hole and dips the oil into five-gallon cans, and if he works rapidly, a can is delivered at the surface every seven minutes. The oil is poured into a large settling jar or barrel and from this it is dipped into five-gallon cans and sold to the large oil companies. Diggers are paid two rupees, (approximately 65 cents) a day for six hours' work. The air pumpers receive three rupees a day, and the coolies eight annas (about sixteen cents).

Scattered among the gushers and right under the noses of the big throbbing engines, there will be a little hand-dug well whose owner refuses to give it up, though he hasn't enough money to improve it and wouldn't if he could. Still, many a modern gusher that has been spouting oil is now on the wane, having had, in the words of the adage, "a short life and a merry one," while the primitive hand-dug well still produces its two barrels of oil a day and probably will for many days to come.

▼ A CAN OF OIL reaches the surface. The mass of iron in the foreground can be dropped into the well to break layers of hard rock

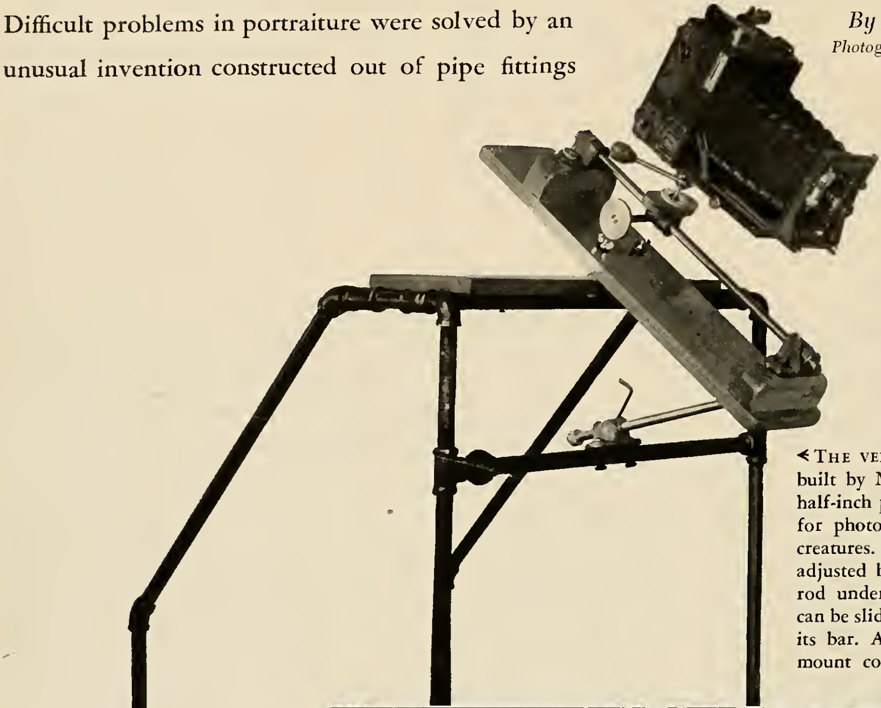
▼ A FOREST OF DERRICKS in the Yenangyaung oil field of Burma

▼ THE OLD AND THE NEW. A hand-dug well surrounded by modern gushers in the chief oil center of the Far East

Photographing

Difficult problems in portraiture were solved by an unusual invention constructed out of pipe fittings

By WILLIAM H. CARR
Photographs by Marvin H. Fros



< THE VERSATILE CAMERA STAND, built by Marvin H. Frost out of half-inch pipe, proved very useful for photographing various small creatures. The tilt board may be adjusted by means of the sliding rod underneath, and the camera can be slid forward or backward on its bar. A ball-and-socket tripod mount completes the mechanism

> THE CAMERA, on its specially designed stand, was focused on a predetermined spot, and the scorpion was then coaxed by means of a camel's hair brush into position. Marvin H. Frost controls the shutter while William H. Carr manages the scorpion. The equipment is in the home of Mr. Carr at Tucson, Arizona. Mr. Carr was formerly director of Bear Mountain Trailside Museums and an Associate Curator of the American Museum of Natural History

CORPIONS

PHOTOGRAPHING scorpions is not exactly a task for one whose nerves are in bad shape. Scorpions are endowed with an exceedingly potent and expertly wielded weapon and do not welcome undue familiarity. In addition, they are able to dash about with amazing speed. When Marvin Frost and I decided to experiment with the living creatures in an effort to make photographs for NATURAL HISTORY Magazine, we knew that the first step was to secure an individual scorpion that would "stay put" long enough for us to capture him upon film. In our rather extended quest for a model we finally came upon "Pete," the largest and most tractable of all the specimens we were able to obtain.

It may seem strange to provide a familiar name for a scorpion, but when one has spent many hours of the days and nights working with any animal, large or small, a comradeship of sorts is bound to develop, and Pete was no exception. He was kept in my home, and I enjoyed a splendid opportunity to observe his ways. On one occasion, while we photographed at night with ultraviolet light, of weak intensity, Pete actually remained in the desired pose, without the slightest movement, for an eighteen-minute exposure. There are not many wild models that will "sit still" for so long a period, especially with their tails raised in the air! However, I am getting ahead of my story.

Mr. Frost had made many pictures of insects and lower animal forms and was determined to accomplish an outstanding job with Pete. We built a plate glass box to permit photography through a transparent medium without reflections or distortions. We designed the box for use from above too. Then it was decided that an ordinary camera tripod would not offer the needed stability or maneuverability, so Mr. Frost constructed a sturdy camera shelf upon a framework of half-inch iron pipe, which was also equipped to hold flood lights. In addition, a method was devised whereby it was possible to mount the camera firmly, yet turn, elevate, or lower it quickly. To accomplish this we used a steel bar, fastened to a hinged, tilting board, and provided with a sliding metal clamp upon which a tripod head was fitted. This made it possible to secure the camera to the clamp and shift it backward and forward or up and down instantly, without the time-consuming manipulation of tripod legs.

The swinging end of the tilt board was held at the desired angle by a movable rod. The mount through which this device passed was bolted to a cross piece of pipe beneath the top shelf. The sliding rod supported the free end or bottom of the hinged board, and it was only necessary to slip the shaft backwards or forwards, in its stationary mount, to the required position. A set-screw clamped it in place. The entire apparatus was not at all complicated and greatly facilitated accuracy and ease in focusing.

My principal contribution was to work with the scorpion, to encourage him to pose in various interesting ways and remain motionless in the face of hot photographic lights placed close at hand. I was also entrusted with the detail of shouting "Ready!" when the subject assumed the desired attitude. A system was employed involving the use of a camel's hair paint brush as a gentle "persuader" to direct the scorpion's movements. A small piece of glass was also used to assist in "herding" the Arizona desert resident as he cavorted about upon the bottom of the photographic cage.

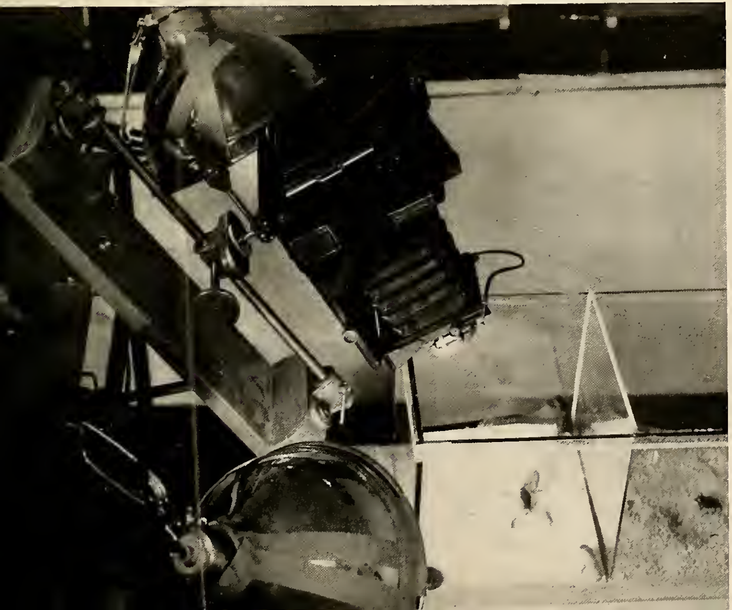
First we would select the spot upon the sand or paper, as the case might be, where the camera was accurately focused. Inasmuch as the pictures were all close-ups, the field of focus was not large and it was necessary to have the scorpion in the exact place before an exposure could be made. This frequently resulted in a great deal of careful activity with the camel's hair brush while I attempted to move the creature into the absolutely precise position without arousing it too much.

While Pete was often an accommodating actor, there were periods when his ability to side-step the paint brush was amazing. Then too, he would sometimes be seized with a sudden desire to rush about in a determined effort to escape. He would struggle against the brush, attempting to push it aside with his strong pincers. Occasionally he would be "all set" in the right pose and then, the moment the lights were switched on, he would scramble off and I would have the fun of rounding him up, over and over again. Even when we confined him in a small space, with the extra piece of glass, he would contrive to move. Whenever a rest period was called, we needed it as badly as did the scorpion.

As time went on Pete accepted captivity very well and seemed to be resigned to posing. When Mr. Frost photographed him through the glass, instead of from above, the creature behaved in exemplary fashion—for a scorpion! It was sometimes a temptation to reach down and grasp Pete with one's hand, in order to place him in the required position, for familiarity often breeds a certain amount of carelessness, but the temptation was resisted in the face of the prominent stinger waved about on high. Our scorpion was not of the exceedingly poisonous variety; nevertheless we maintained our respect for him throughout the experience.

Mr. Frost used a Speed Graphic camera with extension bellows, a Goerz Dogmar, f: 4.5 lens, with a compound shutter, and Ansco Isopan cut film. Two Number 2 daylight photoflood lights provided close-up illumination, and the exposures were one-tenth of a second. The photographer had the patience of Job and the enthusiasm of a boy. More than that, as one spectator put it, "He knew what he was doing!" And that is how the scorpion photographs were made. Incidentally, Pete is still with me.

▼ ALL SET for a partial overhead shot, with lights attached on each side of the camera. Glass plates permit full control of illumination



LETTERS *Continued from page 49*

way of really capturing the beauty of nature. Then comes the problem of selecting the best type of camera. So here is where I hope that the question and answer section of NATURAL HISTORY will come to the rescue.

What are the most suitable cameras for the various types of work in this field of photography, and is there such a thing as a good all-around natural history camera, handy in size and rugged in construction?

JOHN A. STEWART, JR.
Trenton, N. J.

There is really no universal camera for natural history photography.

Probably the best general type is the camera with a ground glass focusing screen, taking a film 3¼" by 4¼" or 4" by 5", with a double extension bellows. Cameras in this category are the Speed Graphic, Ideal, and Linhof. This type is often used by photographer-naturalists bcause good 8" by 10" prints for publication are readily obtainable from negatives of the sizes mentioned. While the film costs somewhat more, this sort of camera is very valuable because it is easily focused over a wide range from infinity to close-up work for life-size images. An adapter to permit use of 35mm. film makes them "mini-cameras" with long focus lenses. The addition of a supplementary lens (Portra or Proxar), such as is slipped over the regular lens of a roll film camera for close-ups, will afford an opportunity to make greater magnification than natural size.

Another excellent combination for close-up photography is the Leica with sliding copy attachment or the Speed-o-copy extension tubes. These are used on a tripod to ensure accurate composition and focus. The main advantage is that nearly every type of subject can be reproduced as seen on the ground glass at whatever magnification desired.

For color photography, kodachrome film can be procured to fit any of the cameras mentioned.

Of course, a person can make excellent natural history pictures with any roll film camera provided he uses supplementary lenses for closer than the shortest distances marked on the camera's focusing scale. Accurate measurement from lens to subject is then necessary, however, and composition is a major difficulty, because no means is provided for viewing the included area.

For information about the developing and printing of negatives, we refer you to your library where you should find many excellent books on the subject.

Motion pictures of birds are best made with a long focus lens from a blind. To amplify this subject would require the writing of a book. Patience is the most important factor in this sort of work.

To produce the type of illustrations seen in publications or in lectures requires plenty of time, a knowledge of photographic equipment gained through experience, and, most important, a strong

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

Insects in the House

THE CLUSTER FLY

By C. H. CURRAN

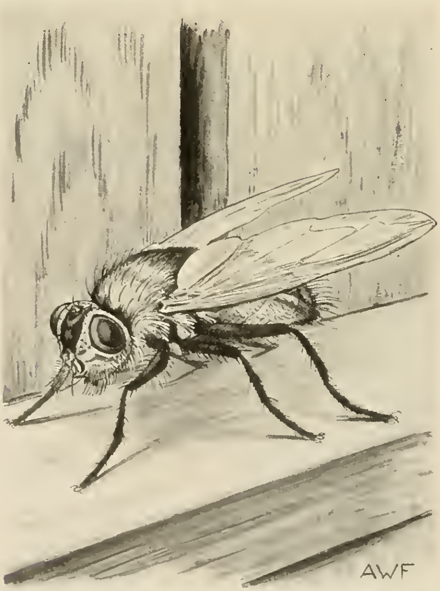
Associate Curator,
Department of Insects and Spiders,
American Museum of Natural History

If on warm days in winter a loud buzzing is heard within the walls of the house, it may be caused by the cluster fly, *Pollenia rudis.* A few of the insects may find their way into the room. But it is only when they hibernate in the attic that they are likely to become a nuisance.

These flies are large and therefore have more difficulty in finding an entrance to a building than the elm leaf beetle, which will be discussed in a coming issue. Cluster flies are hardy creatures and return to the open during the first warm days of spring.

In attics they may be killed by liberal use of a fly spray. Entry into the house can be prevented by sealing all openings.

The larvae of the cluster fly are parasitic on earthworms. Therefore it is not feasible to destroy them at that stage.



Drawing by Alma Froderstrom

FINE YELLOW HAIRS on the thorax will help you recognize the cluster fly. Here the insect is shown six or seven times actual size desire to accomplish something better than has already been done.

Thane L. Bierwert,
Acting Chief, Division of Photography.
The American Museum of Natural History.

* * *

Sirs:

I have a question for your question and answer department. Is it possible for an earthquake to affect a setting of eggs? Neighbors blamed the failure of eggs to hatch on a slight tremor we had this spring. A local turkey rancher claimed he lost a great deal of money due to the tremor affecting his eggs. I cannot conceive any reason for these statements, because eggs are turned during the setting period anyhow.

(Mrs.) Bill Lancaster.
Kent, Washington

It has been shown that the hatchability of chicken eggs is greatly reduced by repeated shocks. In one experiment 155 eggs were placed in an incubator and the table on which it rested was struck with a 1-pound weight at the rate of 52 blows per minute for one minute out of every 15. When this procedure was continued for 8 hours (from the fourth to the twelfth hours of incubation) only one of the 155 eggs hatched. The cause of embryonic mortality appeared to involve failure of the circulatory system and absence of normal development of the brain. I doubt that the minor earthquake which Mrs. Lancaster describes would have exerted as serious an effect as that produced artificially in this experiment; and in any event the disturbance probably did not continue for 8 hours.

There is, however, an alternative explanation which rests upon the assumption that the eggs were being incubated by the turkey hens. It is well known that some birds desert their nests and eggs when disturbed. In at least a few species

Continued on page 96

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YOUR NEW BOOKS

Continued from page 55

in selling war bonds and has toured service camps and veterans' hospitals. His antics were particularly helpful to mental patients. He has been honored at so many fashionable parties that this book includes a veritable Who's Who of the entertainment world. But he has also earned the approval of some very prominent naturalists, so we may all wish him long life and continued prosperity.

James P. Chapin.

BRAZIL, ORCHID OF THE TROPICS

- by Mulford and Racine Foster

Jaques Cattell Press, $3.00
314 pages, 182 illustrations

THE FOSTERS made two expeditions to Brazil in pursuit of new and rare plants. They were particularly interested in gathering epiphytes, which are plants that grow on other plants but are not parasites. The moisture they receive from the air is responsible for their growth, and they are often called air plants. Anyone who has traveled beyond the largest cities of Brazil will feel in accord with the Fosters' description of the inescapable tribulations they experienced. The difficulty and tedium of preserving herbarium specimens of these often succulent-leaved plants in a region where the humidity is high, together with the general hardships in traveling, has meant that collections of Brazilian flora are still very incomplete. The Fosters in a limited time have reaped remarkable results, and for people with the same persistence and enthusiasm an unlimited number of species still await discovery.

Collections were made in a few scattered localities in Baia, Espirito Santo, Minas Geraes, Rio de Janeiro, São Paulo, Paraná, and Matto Grosso. So much time was spent in travel that it was impractical to cover more territory in the time allotted. With only a day or two in any one place it is amazing how much was accomplished and what extensive collections were made. Many other areas could be equally productive, as for instance the dry northern area.

The reviewer feels that a concentrated study of one state with a wide range of climates, such as Minas Geraes, would have been equally productive botanically and far more valuable as a scientific record. Few botanists restrict themselves to the "dead dry stuff stored away in dark closets of a museum," despite what the Fosters seem to think.

Many of the pictures are marred by unskillful retouching and would have been better omitted. The book is interesting and presents a true picture of a plant collectors' hardships and rewards in working in such an unexplored country.

F. H. Pough.

THE DUCKS CAME BACK.

The Story of "Ducks Unlimited"
- - - - by S. Kip Farrington, Jr.

Coward McCann, Inc., $5.00
138 pages, 81 illustrations

THE serious decrease in the number of waterfowl in North America in 1936 induced certain interested sportsmen to formulate plans for an intensified campaign to restore these birds to safer numbers. Thus the association known as "Ducks Unlimited" was incorporated as a non-profit organization in January, 1937, to be followed a little later by "Ducks Unlimited (Canada)." The present volume is largely a history of the parent organization and its northern adjunct, with emphasis on the methods pursued and the results accomplished.

The general plan has been on a vast scale. With the co-operation of local residents and the governments of Canada and the United States, preserves have been established, dams have been constructed to restore desiccated marshland, legislation has been passed to overcome certain unfavorable local practices (such as the burning of hay meadows during duck-nesting seasons), and supervision of the areas has been established. The result, for which the author holds "Ducks Unlimited" to be mainly responsible, has been a positive increase in the duck population, estimated as having, in 1944, reached nearly three times the 1936 figure in four of the Canadian provinces for which the records are given.

Support for the project comes from the membership and from various gun clubs and individuals interested in the success of the operations. Although a large part of the work is done in Canada, the sportsmen of the United States have a vital interest in it since their shooting will, to a large extent, depend on the birds raised in the northern country.

Mr. Farrington discusses other interesting topics such as the flyways followed by the migrating waterfowl, post-breeding northward movements, banding returns, and predator control. Of special interest to hunters are detailed descriptions of shooting grounds and conditions in the various parts of the country. There are many interesting photographs of ducks and geese and portraits of many of the persons who have been active in the work of the association. The colored frontispiece and the chapter headings, by Lynn Bogue Hunt, add an artistic touch to the book, which is one that should appeal to the duck-hunters of the United States and Canada. A Canadian edition of the volume is stated to be of identical date.

J. T. Zimmer.

LETTERS *Continued from page 95*

emotional upset of the parents results in complete loss of broodiness, with the result that the eggs are not incubated and never hatch.

Mr. Nelson Marshall has described mass nest desertion by large colonies of common terns on Starve Island in western Lake Erie. Time and again hundreds of terns joined in communal evening flights and failed to return to their clutches until morning. In some instances desertion was permanent. Nelson was unable to determine the cause of the general exodus, but it seems possible that the flights were set off by some disturbing stimulus. If this was the case, the precipitating cause must have been severe, for under ordinary conditions the tern continues to incubate even though some of the eggs are stolen or broken.

In his informative *Book of the Pigeon*, Mr. C. A. Naether points out that, although our common pigeon is not easily induced to leave its eggs, certain foreign doves and pigeons are. When one attempts to inspect their filled nests, the latter birds often leave for good and refuse to resume their parental responsibilities.

In the case of the wild turkey, nest desertion is not uncommon. Mr. A. Starker Leopold recently spent four years studying the behavior of wild and hybrid turkeys in the Ozarks of Missouri. He found that wild turkey mothers often failed to return after their nests had been discovered by human beings or disturbed by animal foes. Hybrid turkeys derived from a cross between domestic and wild parents do not forsake their eggs as readily as the pure wild ones.

The foregoing observations suggest the possibility that in the situation Mrs. Lancaster describes, the failure of the eggs to develop may have been due to desertion of the nest by the adult turkeys. It is conceivable that even a mild earthquake might prove disturbing to the female and permanently interrupt her tendency to incubate. This interpretation is entirely speculative, of course, but it would be interesting to know whether the turkey rancher noticed a high proportion of nest desertions immediately after the tremor.

F. A. B.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

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SIRS:

The enclosed snapshot may be of interest to readers, particularly those who believe snakes do not cross water.

This rattler was nonchalantly making his way across the Myakka River in Florida directly behind my boat one day when I had but one exposure left in the camera.

CONSTANCE SEDLON.
Cleveland, Ohio.

SIRS:

During a recent voyage along the west coast of South America this vessel encountered an unusually large school of sperm whales. They seemed to be, as far as we could determine, in some sort of mass migration. At the suggestion of the ship's Captain, who has sailed this coast for many years and has seen nothing that could compare with this, I shall describe what we observed.

On the morning of August 28, 1945, we were northbound off Aguja Cape, Peru. Shortly before 9:00 A.M. individual groups of from two to six sperm whales were seen dotting the visible surface of the ocean. They were all traveling south. A short while later the number of groups increased until the entire ocean, to all visible limits of the horizon, seemed spotted with them. The sum total was a school of gigantic proportions—all headed south. It took the vessel nearly an hour to travel through the main body of the school, and the ship was proceeding north at full speed. Several times a collision with a whale was narrowly averted, as they apparently held little fear of the ship and as often as not would stay on the surface rather than sound. This afforded close inspection and positive identification of the whales.

During the remainder of the morning small groups or single straggling whales were seen, the last of them being sighted shortly after noon. It is impossible to estimate the number of whales in the school, because the east and west limits could not be ascertained. However, approximately 400 to 600 whales were to be seen at one time from the center of the school and it can safely be assumed that the entire school consisted of well over 1,000 whales.

I hope that this information may be of interest to you. I might add that among all the professional seamen aboard, no one had ever seen a similar sight.

WILLIAM D. BOYER. *Third Officer,*
Grace Line S. S. "Daulton Mann"

The following comments are given by George G. Goodwin, of the American Museum's Department of Mammals:

In this day and age 1,000 monsters like the sperm whale, massed in one great school, are indeed a phenomenon worthy of record. In recent years 30 or 40 would be considered an exceptionally large school of them. What numbers might have congregated in primitive times is not known, but I would assume that they would reach the astounding figure given in this letter by Officer William D. Boyer.

The curtailment of the whaling industry during the recent war could hardly account directly for a school of this magnitude, considering the sperm whale's slow rate of propagation. The sperm whale usually gives birth to only one young at a time, which averages about thirteen feet in length at birth and is suckled by the mother for at least the first six months. The adult reaches a length of 65 feet. Eight or nine years seems to be generally accepted as the normal life span of a sperm whale.

Before the whaling industry with its modern equipment had reduced the whale population to a dangerously low figure, Thomas Beale stated in his *Natural History of the Sperm Whale* (1839) that he had seen one school of as many as five or six hundred. The log books of whaling vessels, so far as I can learn, give no such stupendous figures. C. H. Townsend in a summary of log-book records of American whaling ships shows that between 1761 and 1920, 36,908 sperm whales were captured in all oceans —more than double all other species added together for the same period. As many as 155 individuals were taken by one ship in a three-year cruise. Most of these sperm whales were taken in the North Atlantic, but a considerable percentage were captured on the whaling grounds off the Coast of Peru.

The deepest parts of the ocean are the principal feeding grounds of this whale. It cruises in search of squid and octopus, devouring about a ton each day. Like most other Cetaceans, it loves company and usually travels in schools, although solitary old males are not an unusual occurrence. Four knots is considered the normal cruising rate of the sperm whale, but it can triple this speed when necessary.

[NATURAL HISTORY Magazine would welcome information from others who have observed unusually large schools of whales.—Ed.]

March **NATURAL HISTORY** 1946

aming Wild Flowers · African Chameleon · Kinishba

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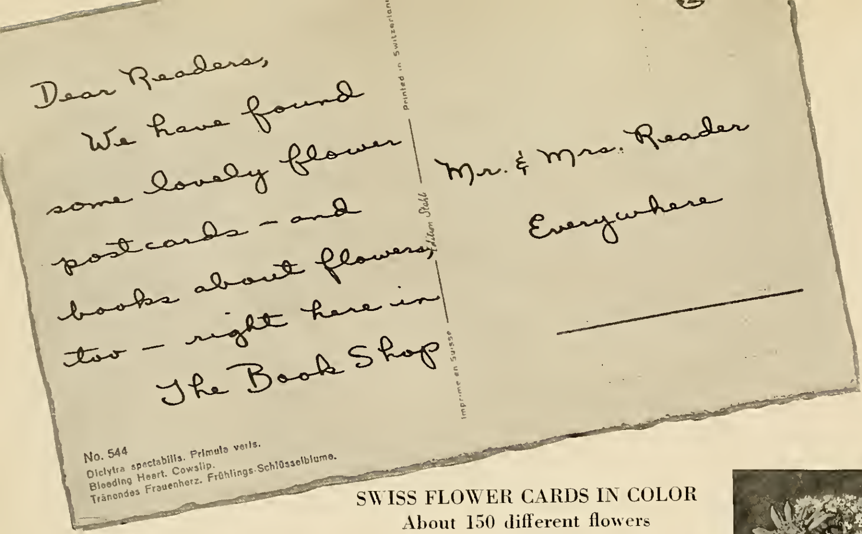

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THE AMERICAN MUSEUM OF NATURAL HISTORY
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LETTERS

SIRS:

I was deeply impressed this morning at reading Dorothy Thompson on peace and the atomic bomb, and I wondered whether in connection with the terrible spectacle which is to take place in the Marshall Islands, there was any protest against the destruction of sea life that must take place. To bomb the desert was one thing, but so to disturb ocean life is quite another. I am writing in the hope that you can tell me whether these great scientists who are helping our present mania for destruction may not be checked by other scientists, not of death but of life? I have no hope that indignant talk will accomplish anything. Every religious prophet has been on the side of life and peace, and war has grown increasingly terrible. I am just one of hundreds of thousands whom the Natural History Museum has taught to love the life of the animal world. Might not an appeal for that life, a scientific appeal, prevent the continuance of this bomb display?

MARY WHITE OVINGTON.
New York, N. Y.

We are reliably informed that it is part of the purpose of the experiment with the atomic bomb in Bikini Atoll to find out what possible damage it might do to the life of the ocean. The site was chosen with a view to minimum risk. A great number of scientists who are concerned not with death but with life have been called in to go out and make their observations, and we can be sure that they will be most critical of the results if any danger of widespread damage is even faintly indicated. In the group are included some of the country's best oceanographers and marine biologists.—ED.

* * *

SIRS:

In the January issue I read the article "Rice as a World Food" with particular interest because my husband served for three years as Rice Physiologist for the state of Texas, and I myself collected and identified rice-field weeds for Texas A. and M. College and the experiment station.

While rice culture in this country is neither as picturesque nor as primitive as that of the Far East, there is a great deal that is interesting about it.

Rice seeding in parts of the South in earlier times was often accomplished by enclosing each grain in a ball of clay so that the seeds would drop to the bottom of the flooded fields. Today rice is planted in Texas by drill machines and in California often by airplane! A far cry from the primitive methods of the Orient and our own earlier experiments.

Weeding must still be done by hand, since rice cannot be cultivated by machine. It is advisable to have a thorough weeding program not only because unwanted plants compete with the rice or even crowd it out, but because the presence of weed seeds greatly lowers the value of the grain going to the mill. One common weed has seeds of a size similar to rice and hence cannot be entirely screened out. These seeds resemble the droppings of mice or rats and, when found in a package of rice, usually mean that some disgruntled customer returns the package and demands his money back.

Birds are another menace to the rice grower, and he sometimes resorts to several methods of defeating them. In Texas the "blackbird" or "rice bird" is one of the worst offenders. Another bird that has taken to rice fields to the despair of the grower is the mud hen. A blackish bird, big of foot and narrow of body, it is shy but persistent. If disturbed it threads its way through the rice stems and becomes lost to sight. The mud hen is unwelcome company because it builds its nest by tangling and weaving the rice stems into a protective mat on which to lay its eggs.

In a country where newcomers like to talk about the swarms of mosquitoes as if they were stampeding elephants, it is surprising that the flooded rice fields contribute little or nothing to this Brobdingnagian population. The reason lies in the tiny fish and minnows that frequent the rivers from which the irrigating water is pumped. These minnows are pumped along with the water into the rice fields and feed on the mosquito larvae.

MRS. NOE HIGINBOTHAM.
South Bend, Indiana

* * *

SIRS:

. . . I have eaten many barracudas both in Aruba and Martinique and am still alive. But what I would like to know is why they would not eat me. Dr. Myron Gordon says they attack things on the surface when they are moving. It happened this way:

In Aruba we had a lagoon in which we went swimming. It was rather safe from shark and barracuda except in February and August, when flying fish were plentiful. We always thought that it was the season of egg-laying for all fishes there and that the preying shark and 'cudas came for the good hunting. One afternoon in February I went swimming with two fellows, and suddenly we saw, quite near by, a school of flying fish coming toward us. As a joke, whenever we saw flying fish, we would say, "Barracudas." We happened to be quite far from shore but on a small sand bank. To see better we got on our feet and the water came a little below our waists. Quicker than it takes to tell, there were six barracudas around us, swimming like lightning. We judged them to be six feet long but probably exaggerated in our fright. One made straight for my legs. I was frantic, and splashed and splashed for dear life. When the 'cuda was about 3 feet from me, he suddenly turned and went.

One of the fellows was so scared he said, "That was the longest ten minutes I have ever spent!"

I answered, "You are crazy; it was not ten minutes but about five seconds in all."

We saw no more of them that day.

Why do you suppose we were a disappointment to them? Were they after those flying fish?

(I have always wanted to say a word about the articles of John Eric Hill with the drawings by G. Frederick Mason. I always read them first; they are super.)

MRS. A. DESBRIERE IRWIN.
Madisonville, Louisville

Mrs. Irwin's question is probably like the familiar one that anglers often ask. "Why," they want to know (after following every rule of the sport in using the proper hook and line, the right bait, and the approved approach), "do some fish refuse to rise to the lure?" About all we can say is that we rejoice with Mrs. Irwin that she is alive to tell the tale.

MYRON GORDON.

* * *

SIRS:

I have just read with interest Dr. Myron Gordon's article entitled "Barracuda, Tiger-of-the-Sea." I note what you say about barracudas caught in Florida waters generally being considered inedible; and, as a matter of fact, my guides have gen-

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President
Albert E. Parr, Director

VOLUME LV—No. 3
MARCH, 1946

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You will find Natural History Magazine indexed in *Readers' Guide to Periodical Literature* in your library

THE COVER THIS MONTH

The beautiful cattleya orchid shown on our cover this month is the new variety Green Gold raised by Harold Patterson & Sons, Bergenfield, N. J. This striking plant is the result of the hybridizing skill of J. P. Mossman, Orchid Glen, Tappan, N. Y. The color photograph is by F. W. Cassebeer of New York City.

Green Gold was first flowered in 1938 from seed sown in 1933 and was obtained from a cross of *C. Thebes* with *C. Princess Royal Alba.* It is an excellent example of the improvement that can be achieved in orchids by careful plant breeding in only 3 or 4 generations from collected wild species. Prominent in its inheritance is the species *C. Dowiana*, a yellow orchid with a gold-veined purplish lip whose native habitat is Colombia and Costa Rica. Also in its ancestry is the species *C. Labiata* from Brazil, a flower with the conventional bitoned purple orchid color.

Hybrid orchids with clear yellow petals and unmarked rich purple lips like Green Gold are in great demand not only for their beauty but also because of their relative scarcity.

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LETTERS

Continued from page 97

erally thrown them away and, certainly, have always preferred other fish for eating.

Much to my surprise, I have found, however, on frequent trips to the Pacific Coast during the war, that barracuda was served in all the restaurants and is considered quite a delicacy. I have never caught any barracudas in the Pacific and am wondering if it is a different breed of fish. Please let me know.

R. S. Pruitt.

New York, N. Y.

The Pacific barracuda is *Sphyraena argentea* (the silver one), and we are happy to have Mr. Pruitt's confirmation that it is "quite a delicacy."

The article in Natural History was concerned, for the most part, with the great barracuda, which bears the scientific name of *Sphyraena barracuda.* This is the largest and most dangerous of the group. There is a smaller barracuda around New York and southern New England, particularly in the summer. This is *Sphyraena borealis* (the northern one), but it never gets much larger than a foot long. It is not at all rare. Farther south, another small species, *Sphyraena guachancho* is common about the West Indies.

Perhaps the notion that barracudas produce a poison known as *ciguatera* to the Cubans, is a provincial taboo dating from some coincidental association of a barracuda platter with some unhappy gastronomic results. As far as is known, none of these barracudas really appear to be poisonous when properly cleaned and promptly prepared.

Myron Gordon.

* * *

Sirs:

The article, "The Aleutians—Island Necklace of the North" (Natural History, December, 1945), with the excellent photographs that accompany it, is of the greatest interest to all concerned with geologic studies in the Aleutians. Mr. Freiday is to be congratulated on the work that he has accomplished in the time available to him after the performance of his official duties.

The paucity of library facilities available to Mr. Freiday at his official station doubtless accounts for his lack of awareness of some of the earlier geologic work done in the Aleutian Islands and on volcanoes elsewhere. Aniakchak, for instance, is generally regarded as a caldera, rather than a crater, and is not the largest known caldera, being far exceeded in size by the Valles caldera, of New Mexico, with diameters of 16 and 18 miles, and by a number of Japanese calderas.[1]

Akutan and Makushin volcanoes are quite well known. A short description of Akutan appeared in 1935,[2] but Mr. Freiday's mention of the sulphur mine thereon is the first that has come to my attention. The sulphur deposits in the crater of Akun volcano, near Akutan, were mined some years ago, and have been known for many years.

The existence of living glaciers on Makushin was apparently first recognized by George Davidson, who made the first recorded ascent of the volcano in 1867, and described the ascent in *Appalachia*, vol. 4 (1884), pp. 1-11. . . .

The presence of glaciers on Mt. Vsevidof and on Mr. Freiday's "Glacier Peak" was apparently first recognized by Robert

---

[1] A communication to Natural History from E. B. Powers, of San Diego, Cal., suggests Ngorongoro, in Tanganyika Territory, as being the largest. Readers interested in pursuing the subject further will find an exhaustive review in "Calderas and their Origin," by Howel Williams, in the University of California Publications, Bulletin Department of Geological Sciences, vol. 25, No. 6 (1941), pp. 239-346.

[2] Finch, R. H., "Akutan volcano": Zeits. f. Vulk., vol. 16 (1935), pp. 155-160.

➤ A Joshua tree in the Joshua National Forest

➤ A single Joshua tree bud

Photos by Gladys Diesing

Dunn (*The Outing Magazine,* March, 1908, pp. 660-671).

To Mr. Dunn, again, belongs the credit for the first published description of the great caldera in the northern part of Umnak Island, which he named Okmok Crater (*The Outing Magazine,* Feb., 1908, pp. 540-550).

Detailed maps of Okmok caldera (prepared by the Corps of Engineers, U. S. Army, since Mr. Freiday's article was written) show that the highest points on the rim of the caldera are more than 3500 feet high, and the outlet of the floor has an altitude of about 1100 feet.

Other geologists who have visited the caldera are extremely doubtful as to whether any considerable portion of the floor has ever been filled by glacial ice. No evidence of glacial erosion was found on the walls of the outlet gap of the caldera.

ROBERT R. COATS,
Geologist.

(Published by permission of the Director, United States Geological Survey.)

Washington, D. C.

* * *

SIRS:

I read the following statement in a newspaper:

"Question: Please describe the method used by a fox to rid himself of fleas.

"Answer: Taking in his mouth a tuft of wool or a piece of wood, the fox slowly submerges himself, tail first in a pond. The fleas are driven forward onto the piece of wool or wood, which is then set adrift by the fox."

It sounds more foolish than incredible and I am curious to know what you would have to say about it. . . .

MARGARET N. MORRISON.

West Hartford, Conn.

Dr. John Eric Hill of the American Museum's Department of Mammals makes the following comment:

The story of the fox getting rid of fleas is an old one and is quoted in a number of natural histories. I do not believe it, but would find an absolute disproof difficult.

Fleas would surely stay close to the skin, where there would be enough air imprisoned by the fur to prevent wetting for some time. It takes a lot of submerging to wet a fox to the skin. Most aquatic animals with fur have fleas. Sea-otter, otter, beaver, and muskrat all have fleas in spite of their living in the water so much of the time.

On the negative side, no competent observer to my knowledge has claimed to have observed this action. It is usually quoted as if it were general knowledge, yet specific instances where people have claimed to see it are rare. This is the usual case in false folk-lore, to which category I am quite sure this story belongs.

Perhaps someone with a flea-bitten dog would be scientifically-minded enough to try to get rid of its fleas in this way and as evidence would preserve the fleas that flee to the piece of fleece.

* * *

SIRS:

I want to express to you in writing my deep enjoyment and appreciation of all your issues of NATURAL HISTORY.

Most recently, the article on Scorpions, with which I have had in past years some personal acquaintance, seemed to me a classic—direct, simple, authoritative. And not least, the inclusion of how-it-was-done should prove an inspiration to many who are directly or indirectly in a position to study and record "Nature in her visible forms." Doing so is not a simple matter, but one requiring skill and infinite patience.

Again I congratulate you.

(Signed) "INTERESTED."

* * *

HAS THE WISENT SURVIVED THE SECOND WORLD WAR?

SIRS:

. . . It is truly amazing how, in spite of all the shortages and restrictions, you have maintained the high standards of both content and appearance in NATURAL HISTORY throughout the wartime years. I have enjoyed each and every issue. Especially outstanding in my opinion have been your series on "Strategic Minerals" and "Strategic Plants," Dr. Murphy's Chocó articles, and Dr. Wissler's on the beginnings of civilization, as well as Dr. Mayr's article on the Birds of Paradise . . .

I would greatly appreciate it if the staff of the museum could tell me what is the present status of the European Bison. I know that World War I almost destroyed the species, and am wondering how World War II has affected it . . .

ROBERT L. KENDIG.

Bryn Athyn, Penna.

The following answer is offered by George G. Goodwin, Associate Curator in the American Museum's Department of Mammals:

Mr. Kendig is correct in saying that Europe's largest and once most famous big game animal, which in medieval times haunted the great forests of Germany, Poland, and Russia, was all but exterminated during World War I. Except for a few pampered and park-bred animals, this great European bison, the so-called wisent (pronounced WEE-zent), was doomed to annihilation with the retreat of the German troops from the Russian frontier in 1918.

In general appearance, the closest living animal to the wisent is the wood buffalo of western Canada. Professor Rowen of the University of Edmonton has even intimated that the wood buffalo of Canada might be more closely related to the wisent of Europe than to our own plains bison. It is significant that both the wood buffalo and the wisent are forest animals. Furthermore, the latitudinal range in each case is on the same parallel.

The German military authorities in World War I can be credited with having made every effort to preserve the wisent during their advance and occupation of the Bjcloviesk Forest. But the 185 animals that survived the actual period of hostilities were slaughtered by poachers and hunters when German protection was removed. The climax of this regrettable tragedy can be dated February 19, 1921, when Bartoleus Szpakowicz shot and killed a wisent that was the last wild bison in Poland and probably the last in all continental Europe.

The Forest of Bjcloviesk is the remnant of what was known to the Romans as the Hercynian Forest, and the animal was still abundant when they invaded this region. Julius Caesar was so impressed with the animal that he took care to mention it in his "Commentaries." After the fall of the Roman Empire the number of wisent diminished rapidly. Konrad Gesner, the Swiss naturalist, states that in 1555 the wisent was still found in eastern Prussia, Poland, and Hungary. Two centuries later, however, the wisent was considered a rare animal in Europe. Frederick the Great did much to preserve it during his life and assigned game wardens to protect it. The peak of abundance in later years seems to have been in 1853, when the number in the Forest increased to more than 1500.

Meanwhile, news of a wisent herd in Caucasia reached Europe. A Caucasian officer, with troops brought to stop the Polish rebellion during the middle of the last century, recognized a wisent in the museum at Lublin. He informed the authorities that he knew this animal from his native mountains, and an investigation proved his assumption correct.

At the outbreak of World War I, 770 wild European bison lived in the great Lithuanian Forest of Bjcloviesk, near Gradno, and were under the protection of the existing Russian government. The herd in northwestern Caucasia, in the Kuban region, numbered between 650 and 700, making a total of about 1400 wild European bison. The Caucasian herd was slaughtered to the last animal during the Russian Revolution. When world conditions were once more restored to normal, it was found that scarcely 50 European bison remained. These were scattered through zoological gardens and parks. The International Society for the Conservation of the Wisent was then established. The task of saving the wisent was entrusted to two brothers, Lutz and Heinrich Heck, directors of the Zoologi-

Continued on page 148

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

YOUR NEW BOOKS

SHELLS ● JOHN MUIR ● QUEST FOR GOLD
HORSES ● TIBET ● ASTRONOMY

FISHES AND SHELLS OF THE PACIFIC WORLD

- - - - - - John T. Nichols and Paul Bartsch

The Macmillan Co., $2.50
The Infantry Journal
192 pages, 83 figures

A FEW years ago, the words "Pacific Ocean" brought to the minds of many people a large double-page map in an atlas, exhibiting huge expanses of ocean, sprinkled here and there, at wide intervals, with pepperings of tiny and insignificant dots.

Since the war, however, millions of young men and women have come back from the South Seas with indelible impressions of vast, tossing wastes of Pacific waters, while the former "dots" have resolved themselves into mountain-dominated bodies of land or far-flung, low-lying coral archipelagoes, in both cases, surrounded or associated with living barriers of surf-washed coral reefs.

The men have brought back with them vivid memories of the strange, gaudily colored reef-fishes and the beautiful shells with which the lagoons abound. They have also returned with numerous questions, "What was this fish?" "What is this shell, and what are the habits of the living animal?"

It is remarkable to note how many of these questions have been answered in this interesting and well-planned book by Nichols and Bartsch. The authors, out of thousands of species, have selected those most likely to have been noticed and those of special interest for various reasons, and have given brief, but clear and lucid descriptions of their appearance, habits, and unusual peculiarities.

In this way, they have covered sharks, rays, the brilliantly colored parrot-fishes, wrasses, and butterfly fishes, as well as the little demoiselles. They have included the more grotesque gobies, scorpion fishes, and frog-fishes. Then they dealt with habits and distribution, and they have not omitted the species of economic value.

In similar fashion, the most outstanding and conspicuous shells of the region are covered and described as well as could be done within the limitations of space. The book is well illustrated with drawings and photographs which show the essential characters of the forms described.

It is a pity that this book could not have been issued while our men were still in service, not only to satisfy their natural curiosity about the life with which the coral lagoons abound, but because, at that time, much of the information could have been turned to their practical advantage as well.

ROY WALDO MINER.

SON OF THE WILDERNESS

The Life of John Muir

- - - - - by Linnie Marsh Wolfe

Alfred A. Knopf, $3.50
364 pages, 46 illust.

THIS is the biography of a man who played a prominent part in many fields. He was an ardent field naturalist, a lover of nature, an explorer, an able exponent of the glacial theory, a pioneer in conservation, an inventor, and a man of letters. Mrs. Wolfe has written an intimate account of this genius, and her style has all the conviction of an eye-witness. Biography, to this reviewer, can be deadly dull, but in this instance he was pleasantly surprised to find that the author had entered so completely into the personal characteristics of her subject that the story read almost as told by Muir himself.

A biographer has to be daring to set forth incidents and thoughts as if known by actual observation; too often a style which attempts to brighten the pages in this fashion treads close upon fiction. This author documents her volume so thoroughly, often quoting Muir directly, that the reader gains an impression of realism with no strain upon his credulity. It is to be expected that the biographer will devote most of the space to increasing the stature of her hero, but then nature did cast Muir in an heroic role and the public will be most interested in the very qualities which made him great. Nevertheless, we are told, although near the end of the book, that Muir had some of the very human attributes he should have had to escape being legendary.

In a brief review such as this, one cannot outline the contents of the book. It is sufficient to inform the prospective reader that the biographer has performed her task well, that Muir lived a very full life, doing things that are of importance to us all, that his associations were of historical interest and significance, and to further state that while Muir occupies the center of the stage the limelight strikes upon the contemporary scene as well, and this adds interest to the book.

H. E. ANTHONY.

THUNDER GODS GOLD

- - - - - - - - - - by Barry Storm

Southwest Publishing Co., $2.75
116 pages, 19 illust.

THIS is a tale of lost mines, cryptic maps, treachery and murder, revolving around the quest for gold in the Superstition Mountains of southern Arizona.

In these mountains, home of the Thunder Gods of the Apache Indians, Pedro Peralta discovered fabulously rich ore in 1846. He returned in 1847 with 68 men to mine the deposit, after furnishing his two brothers in Mexico with rough maps locating the discovery site. The Apaches, outraged at the violation of their sacred land, massacred the party and carefully covered all but one of the nine small tunnels which they had driven. The uncovered tunnel was considered so inaccessible that it was not likely ever to be rediscovered. But it was found, in 1871, by two prospectors who had been given one of the Peralta maps. Through the simple expedient of murdering these prospectors, the mine came into the possession of Walz and Wiser, German immigrants; Walz immediately murdered Wiser and had sole possession. For years Walz brought out burro-loads of ore assaying more than $10,000 a ton. Despite many efforts to trail him he kept his location a secret, and with his death the mine became the much sought-after "Lost Dutchman Mine." Again and again, as years passed, rich ore was found in the area, and one of the poorer Peralta mines was located in 1940, but murder and misadventure has dogged the seekers of this fortune, and the bonanza ores are still being sought.

Within this book we have the story of this varied history, told by a man who has been one of the more persistent seekers. The work is documented with terminal "Notes of Authenticity," with numerous photographs, and with reproductions of maps left by past seekers. It is an adventure tale and a saga of the southwestern desert land, that, in its appeal to the universal lure of adventure and treasure trove, should be widely appreciated.

H. E. VOKES.

LIGHT HORSES

- - - - - - - - by Cecil F. Rooks

Ziff-Davis Publishing Co., $2.00
159 pages, 108 illust.

HORSE lovers, especially those who are beginners in horsemanship, will find in this book a valuable store of information on riding and driving horses. All the common breeds in America are described and compared and their special values given. There are good descriptions of the gaits of a riding horse, each illustrated.

Equipment for riding and driving is discussed, as well as the proper manner to hold the reins and riding form. A section is devoted to training saddle and driving horses, learning to jump, teaching special gaits, and overcoming bad habits. In Iowa, where Mr. Rooks lives, a number of riders go for a three-day, hundred-mile trail ride each fall. Conditioning a horse for competition in these rides is important, as most horses (and riders) from the city are too soft to cover the distance without hardening exercises. The winner of several rides is quoted at length as to his methods of preparing his mount for the trail.

Grooming is necessary to keep a horse in good condition; it also reveals any injuries or swellings that may develop. Proper shoeing and trimming of the hoof helps colts develop proper foot-structure and may be used to correct wrong functioning. Other subjects discussed are the ailments of horses and the points one should consider in buying a horse.

The author is well qualified to write on the care and training of horses, having worked with them since early childhood. He is now Field Representative of the Iowa Horse and Mule Breeders Association, Associate Editor of *Midwestern Horseman* Magazine, and he frequently serves as judge at horseshows.

J. E. HILL.

GUIDE TO SOUTHERN TREES

- - - - by Elwood S. Harrar and J. George Harrar

Whittlesey House, $4.50
712 pages, 73 plates

HERE is a guide to the trees of the southwestern United States that will be welcomed by many naturalists whose homes are south of the Mason and Dixon's Line, or who may have the privilege of visiting this interesting region. More than 350 species are described, and

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THE GREAT SIERRA

Snow Survey

By C. Frank Brockman

All photographs by California State Department of Public Works, Div. of Water Resources, unless otherwise credited

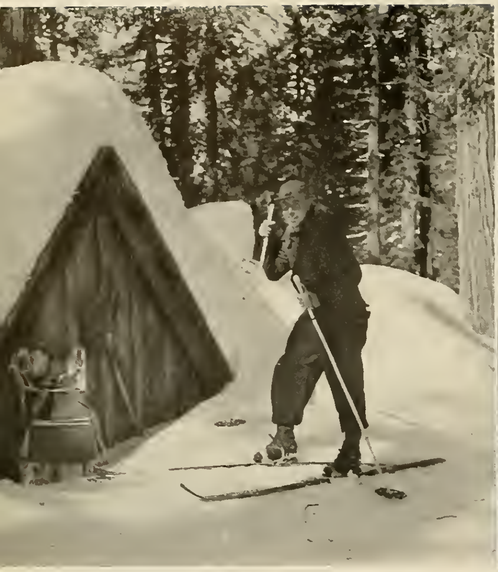
THREE figures, crouched against the force of the driving wind, plodded wearily across a snow-blanketed meadow, their skis hissing through the thin crust with every step. At intervals, the lead man would drop behind, and to the next in line would fall the laborious task of breaking trail. All day soggy gray clouds had obscured the lofty pinnacles round about, but now they began to lose their burden and the first snowflakes whipped out of the gloom of the ebbing day to sting the faces of the travelers. Doggedly they pushed forward toward the dim outline of a timbered slope on the far side of the meadow, toward the sanctuary of a small cabin, completely buried beneath the drifted snow. Rest, relaxation, a warm fire, and food would be a welcome respite from the long day of fatiguing travel—especially in the prospect of a gathering storm.

These men were not pleasure skiers; they were snow surveyors, and their work in this winter wilderness, far from the customary routes of travel, was of vital importance to thousands of people in the valleys below. Their journey would produce one segment of the information that would determine the amount of water stored in the heavy snowpack high in the Sierra Nevada. With this information, farmers in the San Joaquin and Sacramento Valleys could plan their activities intelligently for the coming dry season. Power companies would be able to make estimates of the potential electricity that their turbines would generate. Mining, manufacturing, and a wide variety of similar industries would be served. If a heavy snowpack indicated an exceptionally heavy run-off with the possibility of floods, storage reservoirs could be held at low levels as long as much snow remained high in the mountains. The heavy run-off could then be absorbed as it developed and floods could be prevented along the lower reaches of the streams. Or if a light snowpack warned of a scarcity of water during the coming summer, plans could be made for its careful conservation and distribution.

High in the Sierra Nevada, snow surveyors on skis forecast the livelihood of thousands of people in the San Joaquin and Sacramento Valleys

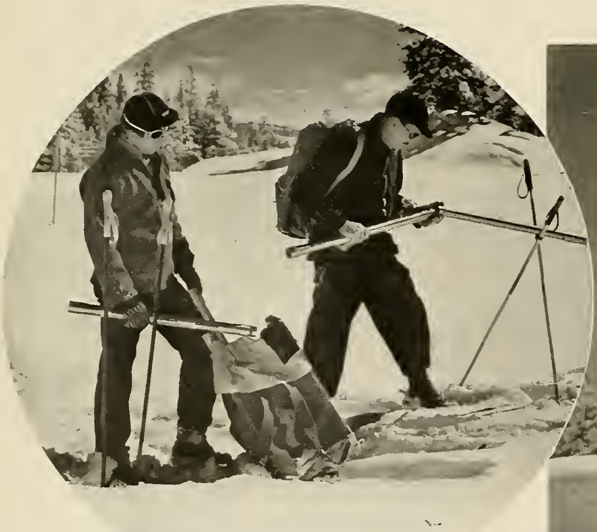
As rain rarely falls in these regions from June to October, all water used during that period must be supplied from the precipitation of the preceding winter, held over by natural agencies or by artificial control. The rugged Sierra Nevada, extending north and south in California for over 400 miles, intercepts the moisture-laden winds that sweep in from the Pacific during the winter. Here at high altitudes are vast watersheds, upon which precipitation in winter falls entirely in the form of snow and accumulates to great depths, covering an area of about 17,000 square miles. Cold prevents the snowpack from melting until the valleys far below are firmly in the embrace of summer. Even then, it melts slowly enough so that the natural run-off provides a plentiful supply of water until well into the dry season. If this water is then carefully controlled and regulated by reservoirs, a dependable year-round supply is assured.

HARD GOING in deep snow. Occa-
ionally snow surveyors must ski long
istances under such conditions. Each
ear 150 men travel a total of 4500 miles

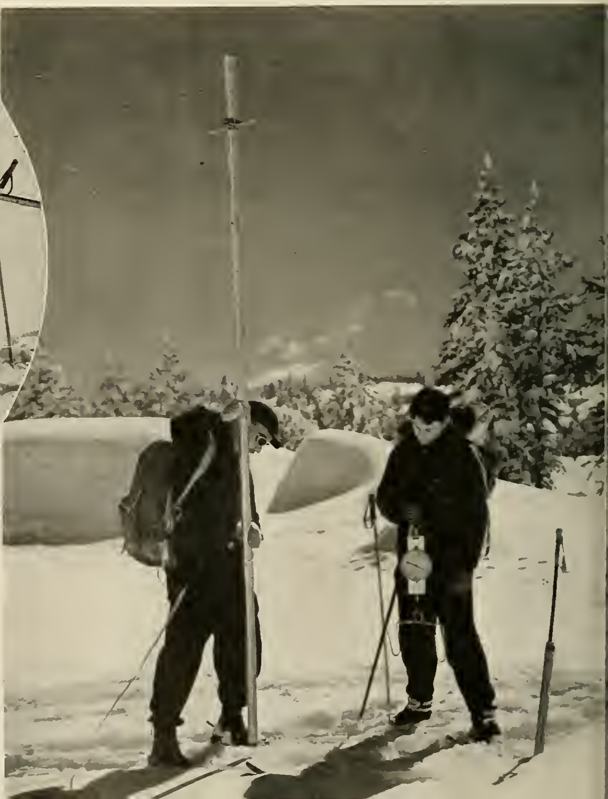


⮝ Snow survey cabin almost covered by deep snow. A shovel secured high in the gable enables the men to gain entrance

⮝ One of numerous reservoirs fed by Sierra Nevada snows: Don Pedro Dam, which supplies water for the Turlock and Modesto Irrigation Districts. Snow measured at Dana Meadows at the end of March is water in the dam by June or July



⮝ Arriving at the snow course, aluminum tubes are joined together for taking samples

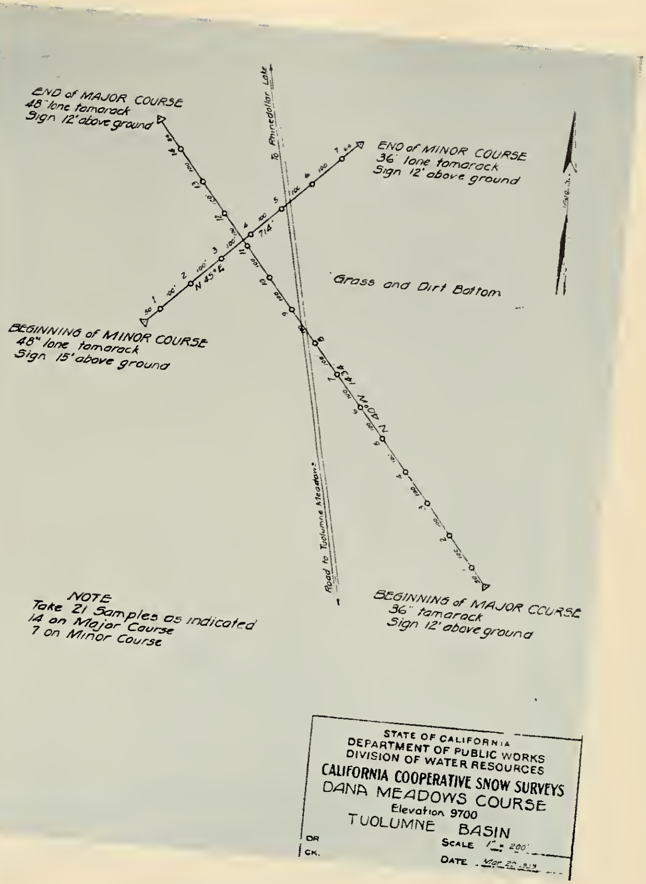


➤ Ready to take a snow sample. Slots along the side of the tube show the depth of the snow

Much of the economy of California therefore depends upon snow, and the evaluation of the Sierra snowpack is a serious business.

The average person usually appreciates the value of man-made dams and reservoirs, but he is seldom fully aware of the immense volume of water that is stored in the winter snows of high mountains. On April 1, 1938, for example, Mr. Fred Paget, who is in charge of the snow survey work for the California State Division of Water Resources, reported that eight times as much water was held in storage in the Sierra snowpack as in the surrounding man-made reservoirs.

For many years, various California water-using agencies, aware of the importance of the Sierra snowpack, conducted individual surveys on watersheds on their own initiative. In 1930, however, the snow survey work was organized on a consolidated over-all basis. It operates under the direction and leadership of the Division of Water


END of MAJOR COURSE
48" lone tamarack
Sign 12' above ground
END of MINOR COURSE
36" lone tamarack
Sign 12' above ground
To Rhinedollar Lake
Grass and Dirt Bottom
BEGINNING of MINOR COURSE
48" lone tamarack
Sign 15' above ground
N 45° E
Road to Tuolumne Meadows
NOTE
Take 21 Samples as indicated
14 on Major Course
7 on Minor Course
BEGINNING of MAJOR COURSE
36" tamarack
Sign 12' above ground
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
CALIFORNIA COOPERATIVE SNOW SURVEYS
DANA MEADOWS COURSE
Elevation 9700
TUOLUMNE BASIN
DR
CK.
SCALE 1" = 200'
DATE

▲ **MAP** of a typical snow course—Dana Meadows, Yosemite National Park (9700 ft.). Some courses are at higher elevations. Maps like this are made for all snow courses. Samples are taken at 50- or 100-foot intervals

THE TUBE is thrust through the snow to
e ground and withdrawn with the sample
side. The weight of the sample will in-
cate the amount of water in the snow

TO DETERMINE the water content of the
ow sample, the tube, with its snow core,
weighed on scales that indicate the
uivalent directly in inches of water

Resources of the California Department of Public Works. From January to the first week in May, the Sierra snowpack is subjected to careful, standardized investigation. Progress surveys are made each month throughout this period, but the main information is gathered during the last week in March, when the winter storms are about over. At that time, a small army of about 150 snow surveyors are out in the "high country." Twenty-four principal watersheds on both sides of the Sierra are studied. From the headwaters of the Sacramento system on the north to the lower reaches of the Kern on the south, the snowpack is examined for depth and water content at regular intervals and at key locations. In the central office in Sacramento the results are analyzed and scrutinized for possible errors. Computations are then made which permit prediction of the amount of run-off from April to the latter part of July. Finally, this information is published and made available to all co-operating agencies.

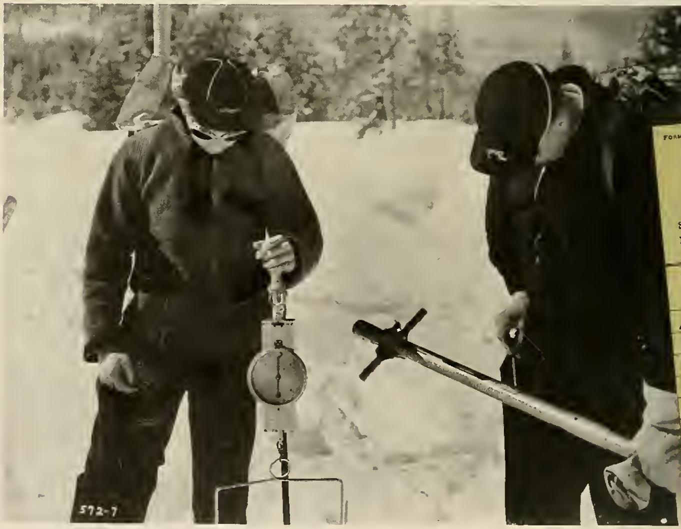
One naturally asks how measurements that are sufficiently accurate can be made. Casual reports of snow depths are not sufficient, since depth alone does not tell the entire story. Snow, when it first falls at high altitudes, usually has a density approximating 10 per cent; that is, 10 inches of snow will yield one inch of water. After several days the new-fallen snow settles and packs to a density of 25 per cent, so that only four inches may be required to produce one inch of water. As the snow continues to fall and increase in depth during the winter, its density becomes still greater, and its crystalline structure is slightly modified by melting at the surface and absorption of free water by the lower layers. A maximum density of about 57 per cent is sometimes reached before the end of winter. Beyond that point, the water is generally no longer retained in the snowpack and runs off from the bottom.

The general method is simple, but the work of gathering and compiling the data requires careful attention to a multitude of details. Places of measurement, known as "snow courses," must be laid out and permanently established. Trails through difficult and often dangerous terrain must be clearly marked so that they can be followed under adverse weather conditions. Shelter cabins must be established at strategic locations and stocked in advance with food, fuel, and bedding. In addition, protection must be provided from marauding bears, as well as from individuals not familiar with the code of mountain ethics. Finally, the men who make the surveys must be of strong physique, familiar with the territory, accustomed to winter travel in the mountains, and capable of taking care of themselves in the emergencies that occasionally arise.

The men generally travel in groups of two or three – never alone–, for the routes are often hazardous, and even slight miscalculations or injuries may be dangerous or even fatal. For this reason, "Fancy Dan" skiers who enjoy taking chances are never used for these missions. In this remote mountain wilderness, the plan is to be safe rather than sorry. Most of the men who remain in the back country all winter are employees of the power companies, together with caretakers of mountain resorts and others whose duties keep them in touch with the wilderness. Rangers of the United States Forest Service and the National Park Service make a great many of the snow surveys in California. Most of the high mountain areas are either National Forests or National Parks, and the rangers make the snow-measuring work a part of their regular winter patrols.

The instruments used for making the tests are a tribute to those who have devised them. Often the measurements must be made under difficult conditions–in freezing cold or in blinding blizzards–, and if the equipment were not simple and efficient, the results would suffer.

Sample localities are selected that are typical of each region from which information is desired. The "snow course" is established in an open area, sheltered if possible



⮝ THE PENCIL indicates the height the snow core has risen in the tube. Snow is visible through the slot

FORM 130
Snow Course
Party ROB
Description of Number of Course
(1)
MAJOR

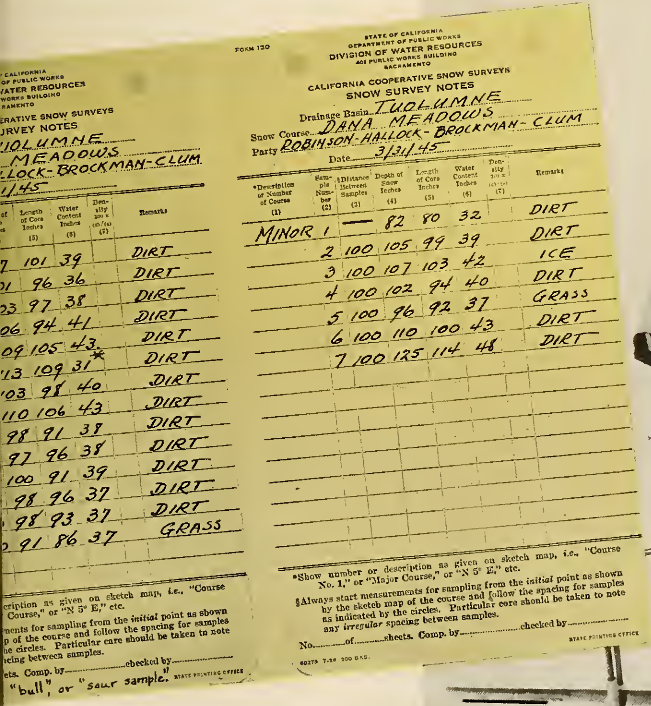
➤ MEASUREMENTS taken at the snow courses are recorded in this manner. "DIRT" or "GRASS" means that the tube went completely through the snow to the ground from driving winds, and a map of the area is prepared to guide the snow surveyors in their work. Within this area, two lines are laid out in the form of a rough cross, and the extremities are marked with conspicuous red and yellow signs. The points at which snow samples are to be taken are then located at more or less regular intervals along the lines between the signs. The number of sample points depends upon the conditions at the site. In some cases, five or six will do. Some courses require thirty or more. The average is around 20. The average from all the sampling points evens out the slight differences caused by uneven ground and drifting snow, and it represents a very accurate figure of the water content of the snow blanket in any particular area.

In sampling the snow at each of the designated points on a given course, the surveyors use a tube of steel or aluminum approximately two inches in diameter. This tube consists of a number of pieces, each 30 inches long, which can be coupled together readily, so that snow depths of 15 feet or more can conveniently be measured. The tube is driven perpendicularly into the snowpack to the ground, and the length of the core of snow inside is easily seen through a slot and is measured against a scale marked on the outside of the tube. Any dirt brought up by the cutter is carefully removed, and the water content of the sample is then determined by weighing the tube with its core of snow on scales that indicate the equivalent amount of water in inches.

This system, is the result of experiments originally conducted by Dr. J. E. Church on Mount Rose near Lake Tahoe about 40 years ago. Dr. Church was Professor of Classics at the University of Nevada, but he possessed a lively interest in the outdoors. From this interest developed a curiosity as to how the water content of the snow on near-by mountains could be determined. He is now on the staff of the Agricultural Experiment Station of the University of Nevada as a meteorologist and is President of the Section on Hydrology of the American Geophysical Union and also of the International Commission of Snow. The value of his work, originally begun as a hobby, was soon recognized. Today, it serves as a basis for snow surveys carried on, not only in California where it has been highly developed, but also in Nevada, Utah, New Mexico, Colorado, Oregon, and parts of Canada, Australia, South America, India, and Russia.

Photo courtesy of Lassen Volcanic National Park

➤ Close-up of scales with tube being weighed for computation of water content



F CALIFORNIA
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ERATIVE SNOW SURVEYS
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MEADOWS
LOCK-BROCKMAN-CLUM
1/45

of	Length of Core Inches (5)	Water Content Inches (6)	Density 100 x (6)/(4) (7)	Remarks
7	101	39		DIRT
1	96	36		DIRT
23	97	38		DIRT
06	94	41		DIRT
09	105	43		DIRT
13	109	31*		DIRT
03	98	40		DIRT
110	106	43		DIRT
98	91	38		DIRT
97	96	38		DIRT
100	91	39		DIRT
98	96	37		DIRT
98	93	37		DIRT
91	86	37		GRASS

cription as given on sketch map, i.e., "Course
Course," or "N 5° E," etc.
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FORM 130

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
401 PUBLIC WORKS BUILDING
SACRAMENTO

CALIFORNIA COOPERATIVE SNOW SURVEYS
SNOW SURVEY NOTES

Drainage Basin TUOLUMNE
Snow Course DANA MEADOWS
Party ROBINSON-HALLOCK-BROCKMAN-CLUM
Date 3/31/45

*Description or Number of Course (1)	Sample Number (2)	§Distance Between Samples (3)	Depth of Snow Inches (4)	Length of Core Inches (5)	Water Content Inches (6)	Density 100 x (6)/(4) (7)	Remarks
MINOR	1	—	82	80	32		DIRT
	2	100	105	99	39		DIRT
	3	100	107	103	42		ICE
	4	100	102	94	40		DIRT
	5	100	96	92	37		GRASS
	6	100	110	100	43		DIRT
	7	100	125	114	48		DIRT

*Show number or description as given on sketch map, i.e., "Course No. 1," or "Major Course," or "N 5° E," etc.

§Always start measurements for sampling from the *initial* point as shown by the sketch map of the course and follow the spacing for samples as indicated by the circles. Particular care should be taken to note any *irregular* spacing between samples.

No..........of..........sheets. Comp. by..........checked by..........

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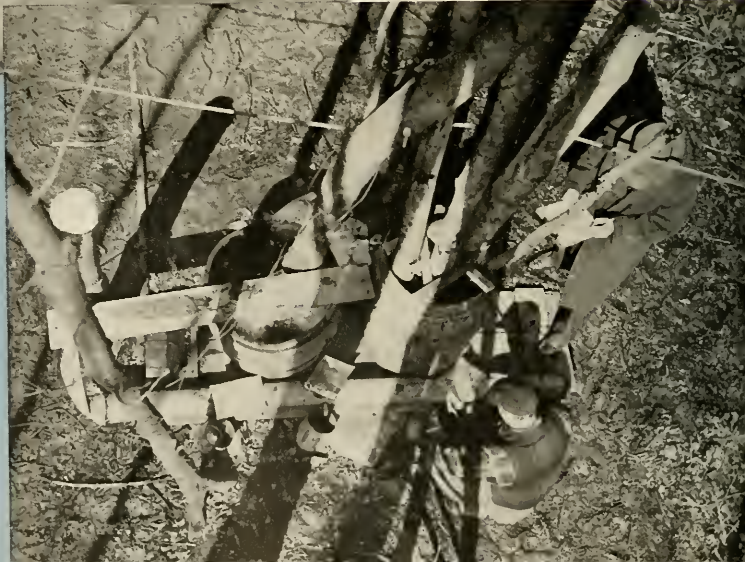
SAP WEATHER

By DOROTHY S. TOWLE

Philip Gendreau, N. Y.

▲ PRACTICAL KNOWLEDGE of sap collecting has been traditional since colonial days, but we are just learning nature's secret of what makes the sap flow



➤ IN THIS DIZZY-LOOKING PICTURE, you look down on two barrels. In the left-hand one stands a tree cut off and set in water, without removing any of its branches. On the right are three eight-foot sections, two right-side up, and one inverted. In the foreground is a horizontal eight-foot section. All four trees, though rootless, produced sap. Clark Stevens is examining one of the sap buckets on the horizontal log, as Russell Eggert makes notes

Strange as it may seem, you need only the trunk of the tree, without roots or branches, to get maple syrup, but the weather must be right

WHEN spring comes to New England—when the days are warm and bright, and the nights still freezing—the old New Englander will sniff the air appreciatively and say, "Sap weather." If you question him, he will tell you other things, too: that sap does not flow when the east wind blows; that only the uninitiated ask a man how many maple trees he has. Those well-versed in maple lore always ask how many buckets he hangs.

But when you ask what it is that makes maple sap flow, the old New Englander will probably say it is just nature's way. This unquestioning acceptance of the fact may satisfy the layman, but the scientist wants to know more than that. Even the scientists, however, have been puzzled about sap flow, and have had a number of explanations to offer.

A year or two ago, Clark Stevens, forester, and Russell Eggert, horticulturist, both at the University of New Hampshire, began a series of experiments designed to test the various theories. The experiments themselves were ingenious, and the results were a surprise even to the experimenters themselves. If their new theory proves valid, you will not need a maple tree at all to get sap enough for your own use—all you will need will be an eight-foot maple log, freshly-cut, a barrel of water, and certain weather conditions. Of course, you won't get as much as you would from a whole tree, but during the so-called "sap weather" you will get a good supply of the best quality sap.

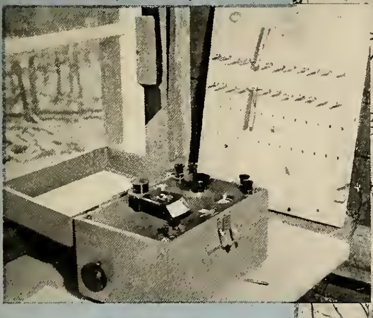
One of the oldest theories about the flow of maple sap was that it was the result of root pressure—the roots forced the sap up into the tree, and when weather conditions were favorable it flowed out through the sap spout. To test this, a tree was cut down, placed in a barrel of water, and tapped. Sap flowed from it as well as it did from the near-by trees that had been left undisturbed for comparison. Therefore root pressure as a cause was eliminated.

A second common theory was that the evaporation of moisture from the leaves and twigs during the summer exerted a pull which brought sap up through tiny tubes in the trunk of the tree, and that the same pull might be felt in winter even though leaves were absent. To test this, a maple was stripped of all its branches, and the scars were sealed over with grafting wax. But the sap flowed just as it did in the normal trees. Therefore, the idea of twigs and branches being responsible for sap flow was thrown out.

Various other tests were tried. One tree had both root and crown removed. The exposed wounds were sealed with grafting wax and the tree put in a barrel of water; again sap flowed normally. Then the tree was turned upside down and placed in water—but the sap continued to flow just as it did from the other trees. Then trees were cut in eight-foot sections and tried upright in water, upside down, and even horizontally with an inner tube of water tied to one end. When moisture was available, sap flowed in every position at the same times it flowed from the control trees, although not in the same quantity. But sap did *not* flow from a whole tree or from the eight-foot sections of a tree cut and placed on a rock.

The general conclusions are that position makes no difference as long

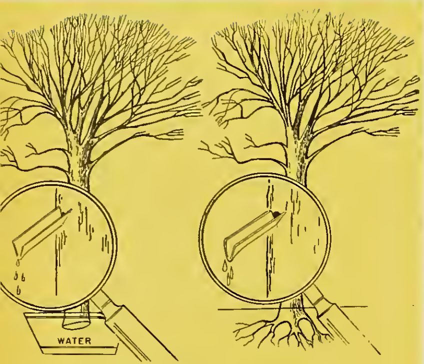
Photo Visual Service, Univ. of New Hampshire



Changing temperature proved be the secret. Here is the electrical paratus used to measure the temrature at various points in the trees. e wired clothespins connect the strument with the tree through a itchboard, as in a telephone office

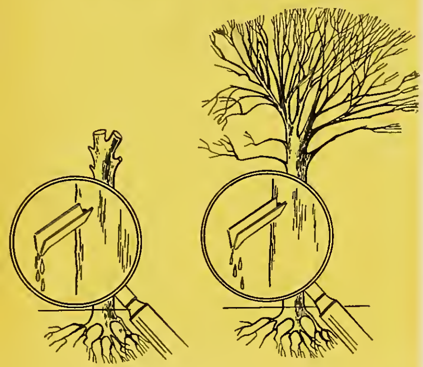
◄ **Clark Stevens** is shown here 30 feet in the air, putting a spout in an inverted tree. The center tree is right-side up, but has had the top and branches taken off. Both are in a barrel of water

▲ **This horizontal eight-foot section** is tapped in three places. The water supply is in the inner tube fastened over the farther end. "Sap weather" was all that was necessary to make this remnant of a tree produce sap

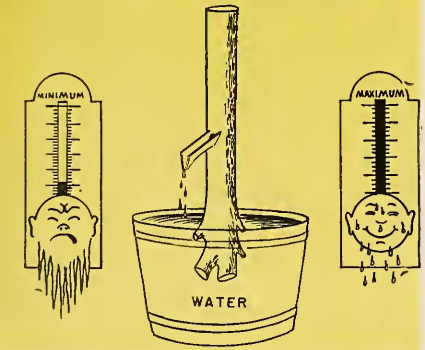


▲ Roots were not necessary

▼ Leaves and branches were not necessary



▼ Even upside down, a maple trunk without roots or branches produced sap when the weather was right



as the tree is placed in water—neither root pressure nor the lifting power that might be ascribed to buds, twigs, or branches is necessary for sap flow. A tree could be upright or upside down, but as long as it could absorb water, the sap would flow just as it did in the normal trees. In fact, eight-foot sections of the trunk behaved just as the whole tree did, and the sap from all parts of the experiment was as sweet as that from the other trees.

With the older theories pretty well exploded, Stevens and Eggert began a series of experiments on the temperature of trees. They measured the temperature inside the trees and found that when the temperature drops below freezing, the outer part of the tree just under the bark, known as the cambium, freezes quickly, following the temperature of the air very closely. Deeper in the wood, the temperature does not change so rapidly. Sometimes the inner part of the tree would not freeze until midnight, whereas the outer part had frozen early in the evening. At other times when the temperature drop was very rapid, the inner part of the tree would freeze sooner.

During the interval between the time when the air went below 32° F. and the center of the tree reached that temperature, the tree was absorbing water. In the trees that were placed in barrels of water, it was possible to see the water disappear, for within a few hours a noticeable air space would form beneath the first thin coat of ice that formed on the water.

Apparently as the outer part of the wood freezes, a tension is set up in the cells, by which water is drawn from the interior of the tree to the outside, and from the bottom to the top. As it gets colder, the freezing penetrates to the heart of the tree and down the trunk until the tree is completely frozen. If the drop in temperature is sudden, not so much water is absorbed; if the drop is slow, the amount is greater.

In order to test this, a tree was split at sunrise, and the wood was found to be full of small ice crystals. Then, later, as soon as the air began to warm up and the sun hit the top of the tree, the temperature in the cambium went up rapidly, even faster than that of the air. On the sunny side of the tree the temperature went as much as 20° higher. The ice crystals melted, and the sap ran out of any convenient opening. If there is no opening in the bark, this freezing and thawing process probably goes on all winter until the tree is no longer able to absorb moisture.

If this theory continues to hold—and neither Stevens nor Eggert has any doubt about it, although they are carrying on additional experiments to test it under all conditions—, it offers a number of interesting angles for speculation. If sap flow is dependent on the temperature of the air, that is, on the recurrent freezing and thawing of the tree, then there is no reason to believe that trees must be tapped only in the spring. What isn't known yet, is whether sap in October will make sugar of as good a quality as that made in the spring. Investigations in Vermont indicate that the sap might contain a form of sugar other than the sucrose we get in the spring. But we do know that at any time during the year when weather conditions are favorable, the maple owner could hang his buckets and sap would run.

Furthermore, if neither roots nor branches are needed, the man who wants to clear out a maple grove could cut a tree in the fall, put the trunk into a well-covered barrel full of water in the dooryard, and get maple sap all season.

So, after many years, science has proved that the New Englander was right when he spoke of "sap weather" and selected freezing nights and warm sunny days to hang his buckets. But now we know that "sap weather" is actually the *cause* of the flow of sap, and not just the accompaniment. Without these weather conditions there would be no maple syrup, for the trees would not be full of melting ice crystals in the morning, and not enough water would be drawn into the trees to cause any flow of sap.

SEAL NAVIGATION

By John Eric Hill

Drawing by

G. Frederick Mason

At this season the Alaska fur seals, or sea bears, begin their journey northward to their land home, the Pribilof Islands. These islands are two small pinpricks on our maps, lost in the middle of Bering Sea. The seals may start thousands of miles away from them in the Pacific Ocean, and during most of their journey they are far from sight of land, yet they swim unerringly to their destination. It is as wonderful as if a man on a life raft, with no instruments or knowledge of the stars, were to sail from San Francisco to Hawaii.

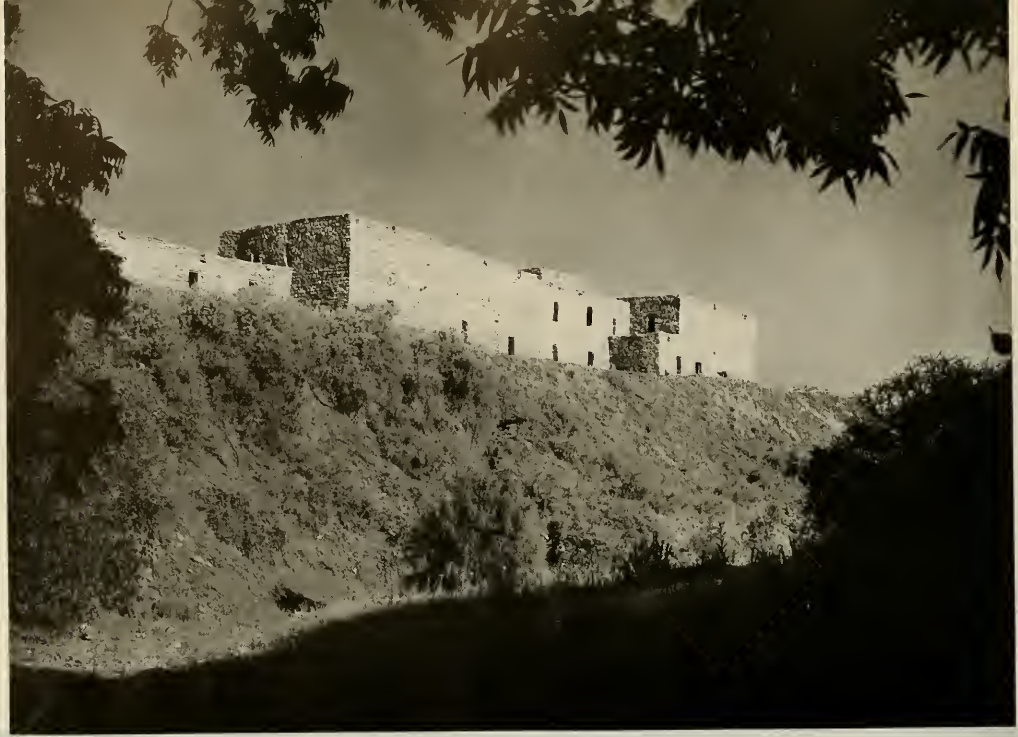
We do not know how the seals find their way through the pathless waters. Do they have an instinct of direction? Do they follow fishes? Are they guided by ocean currents? This last seems most probable, but it is not a simple explanation. A cold current runs southward almost directly past the Pribilofs but is interrupted for almost 500 miles by the warm Japan Current running from west to east, before the line of flow is again parallel to the seals' route.

All winter the fur seals rove the open sea in small groups. Some, the old bulls, or seacatch, winter in the Gulf of Alaska, 500 to 1000 miles southeast of the Pribilofs. The bachelors, or holluschuckie, travel farther south, and the females and young animals go as far as the waters off Santa Barbara, California, 3000 miles airline from their land home. All winter they remain at sea. They sleep easily in the water, "rocked in the cradle of the deep" more literally than any sailor.

With the approach of spring, the fur seals start for home. The bulls reach the island early in May. Hauling out onto the rocky beach, they claim a plot of ground and fight off rivals for it. The females and young seals start for home about the same time, but have much farther to go. Each cow three years or older is pregnant and near the end of her term. Whatever it may be that guides them, the cows are urged forward by the need of a home for their unborn pups. They are not known to land anywhere except on the Pribilofs and are said to maintain a true course. Most of them reach the tiny specks of land in June. The bachelors arrive about the same time, but the young females who have never borne pups do not reach the islands before July or even late in August.

Often a cow appears to seek some particular part of the rookery, perhaps the spot that was her home last year. As soon as she reaches shore, however, the nearest bull goes down to meet her, clucking to her as if coaxing. If he can get between her and the sea, he changes his manner and with a harsh growl drives her to his harem.

Within a few days or even hours after their arrival, each of the older cows is delivered of a single pup. Mating takes place a short time later. After that, the female is allowed to come and go as she pleases. She goes out to sea, often cruising hundreds of miles from the islands, feeding voraciously and remaining in the water until digestion is completed. Then she returns to nurse her pup. Almost as marvelous as her powers of navigation is her ability to find her own baby among the thousands of youngsters that throng the breeding grounds.



KINISHBA—The Brown House of long ago

The story of a warless people who lived in Arizona before the time of Columbus: A romance in archaeology

By Joyce and Josef Muench

All photographs by Josef Muench

THE brown walls of Kinishba, which have given this ancient building its Apache name, are mellow from more than 900 summers under the Arizona sun. Built of native rocks from the White River Valley, they are eminently of the earth, even though they tower to a height of three stories. How they rose from ruins to stand again in a measure of their former dignity is a fascinating story of archaeological exploration.

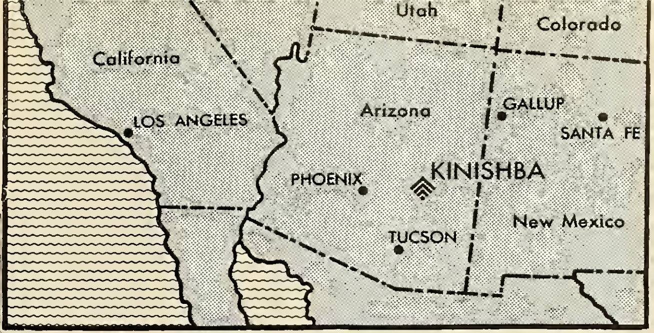
Dr. Byron Cummings, dean of Southwest archaeology, must inevitably take the limelight, and through him must come the interpretation of the life and culture of the peope who once made this their home. He came here first in 1931, at 70 years of age, and began to put into execution the plan for the excavation and restoration of this large community house, which represents the Great Pueblo Culture at its height.

Adolph Bandelier was the first white man to record seeing Kinishba, in April, 1883. It was then only a mound marking the burial ground of the community. "It stands," he wrote, "on both sides of a deep ravine, in the bed of which white pines are growing . . ." Thereafter the ruin was practically undisturbed except by soldiers from Ft. Apache, three miles east, who spent their holidays hunting for pots. Miss Ann Chatham, a teacher at the Indian school on the Ft. Apache Indian Reservation called Dr. Cummings' attention to it, and he went there with some students from his Department of Archaeology at the University of Arizona, in Tucson.

What they saw then would have been vastly discouraging to less inspired people, for sage, squaw bush, rabbit brush, sheep scale, and yuccas had taken over the land for their own. The outlines of the buildings were only vague. They decided to restore what was designated as Group 1 on the east side of the ravine, which was not the largest section but was considered representative and was more accessible. From this first beginning until 1939 the work went on, bringing from the reluctant earth the shape of the past.

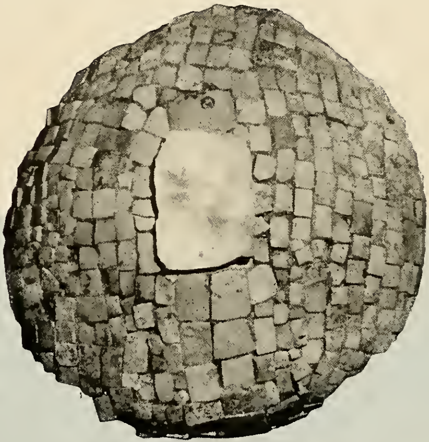
Now, in 1946, Dr. Cummings still

CITY OF LONG AGO. Between A.D. 1050 and 1350 he great communal dwelling of Kinishba hummed vith life. Since then, abandoned, it fell into ruins ntil its excavation and restoration was begun n 1931



RESTORER OF KINISHBA: Dr. Byron Cummings, formerly f the University of Arizona, in front of the Kinishba Museum, holding a beautiful polychrome water olla found in he ruins

PENDANT OF TURQUOISE, probably worn as a chest piece by a prehistoric priest during ceremonies. The tiny rectangles of turquoise and the central piece of abalone shell were "mosaicked" on a thick bivalve shell in a bedding of juniper resin and fine clay

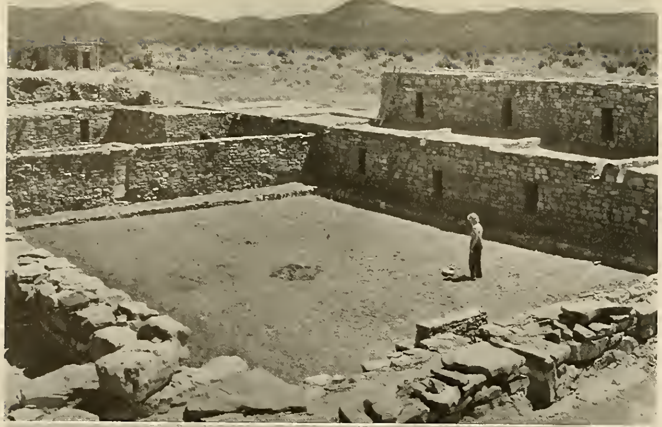


spends his summers here on the 45 fenced acres that are included in the Ft. Apache Reservation. The ruin is maintained and protected by the Indian Service. Next to the massive restored buildings is a museum, with living quarters in the rear, and a windmill, garage, and newly erected "guest house" of four rooms. Beyond the flag that catches every breeze rises the pile of brown masonry, low at one end where the walls are excavated but unrestored, and gradually higher as the eye travels to the two-story levels surrounding the great patio. The background is complete except for the ancient people who were once so busy here. They no longer pass in and out of the low doorways to cultivate their fields or meet in religious ceremonies. But Dr. Cummings makes even the vanished inhabitants take on a tenuous reality as he talks of how they lived and labored before Columbus had touched the shores of America.

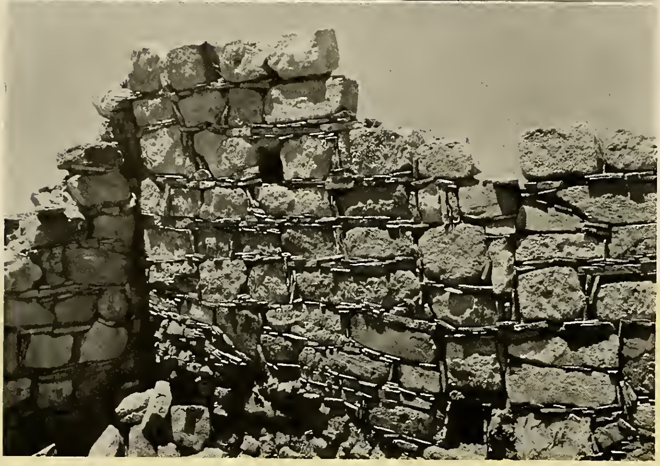
It is known that men lived in this White River Valley from some unknown time before Christ. First they made pithouses, which were dug into the earth and roofed over with branches, perhaps filled in with mud. Gradually stones came into use, and a house was constructed on top of the ground, using native rocks and pillars of wood from trees that grew conveniently in arroyos. Eventually someone started building a house on one side or the other of this particular arroyo, which originally contained a stream that has since dwindled away. This first community was added to and then apparently deserted. Later another was built over it, upon a layer of refuse and fill denoting the passage of time.

The earlier foundation was explored archaeologically and then filled in, leaving the later buildings to look as they did in the final period of occupation. The "city" was mostly constructed between about A.D. 1050 and 1350, during the Great Pueblo Period of the Southwest, and it is with the people of this time that we concern ourselves.

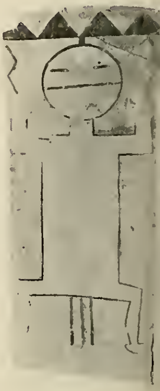
Visitors are always curious as to the size of the aborigines who lived in the tiny rooms and were content with low doorways that make our backs ache as we stoop, straighten,



◂ A LARGE PATIO, in which villagers sitting on the steplike roofs, could participate in religious ceremonies. The ancient walls, restored to something of their former glory, are under the protection of the Indian Service, on the Fort Apache Reservation



◂ EXCAVATED WALL OF KINISHBA, showing the original structure of the masonry



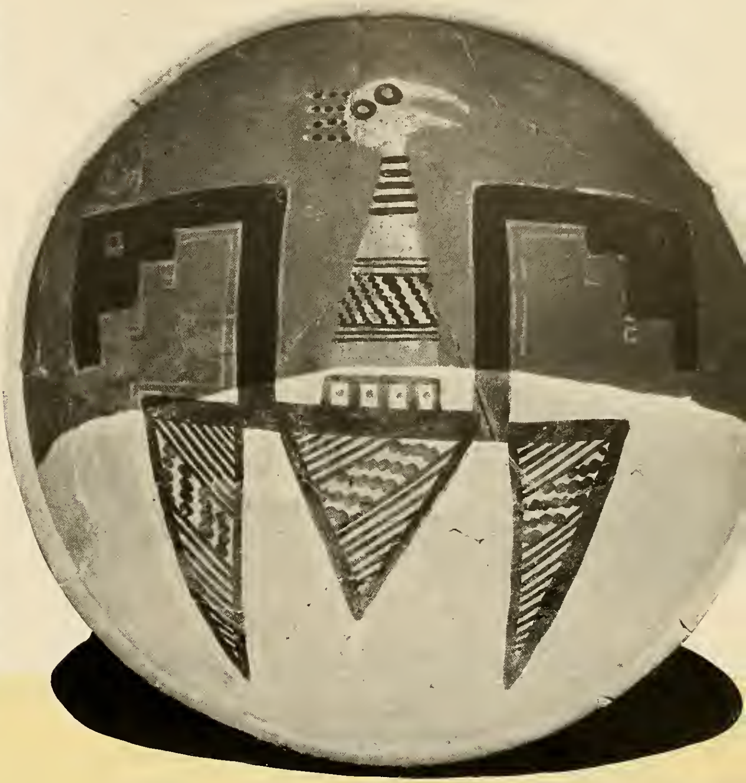
↗ A STONE TABLET, one of the largest with painting on it to come out of the ruins of the Southwest. The headdress of the "dancing priest" symbolizes clouds and lightning, his mask the face of the sun. In each hand is a lightning wand. Size: 3 feet by 16 inches

and stoop again. These people were no dwarfs; various burials prove this. They were simply an outdoor people, using the rooms for storage, and for shelter in inclement weather. For the same reason they needed no "furniture." Like the Navajo or Apache of today, who has not yet succumbed to the use of our metal stoves, they built small fires and roasted their corn in the ashes. They raised squash and knew the food value of many of the wild plants. They probably ate the fruit of *Yucca bassata* (the banana yucca) and used the fiber for a number of purposes. It is found in the sandals that were tossed aside after hard wear and was used as binding for axes and hammers as well as in the joining of timbers. It could be made into brushes, and the sharp spines were serviceable as drills.

Religion bound the community together and influenced every phase of life. The pictures on the pottery and on the bones of animals hunted, and even the shape of some of the rooms can be connected with the religious beliefs of the people. In so many of the Southwest ruins the most striking feature of the buildings, at least to the average layman, is the round kiva, the underground chamber where each clan carried on ceremonies. Here at Kinishba there is only one underground chamber, and it is rectangular. It has been restored, and a ladder permits the visitor to climb down through the roof into its dark interior.

Dr. Cummings says that this room was evidently unused for a long time before the ruins were abandoned and had been half filled with debris by the later dwellers. We cannot know surely whether this was because the settlement was abandoned by the people who regarded such rooms as necessary or because the legends of man's emergence from the underworld (still current among the Hopis) gradually were forgotten. But for whatever reason, the ceremonies apparently had come out of the dark, closed chambers and were carried on in the roomy patio, where a low earthen bench adjoining the walls gave room for the whole community. The first floor living rooms opened onto this courtyard, and the people in the upper chambers, which were in terrace formation, could sit on their porches (which were the roofs of the lower story) to participate. An unmistakable altar stands in the patio, and in

◄ HAMMERS AND AXES found in the ruins and used during the height of the Great Pueblo Period, from about A.D. 1050 to 1350. They are all of diorite and had handles, probably of young oak, ash, or water birch



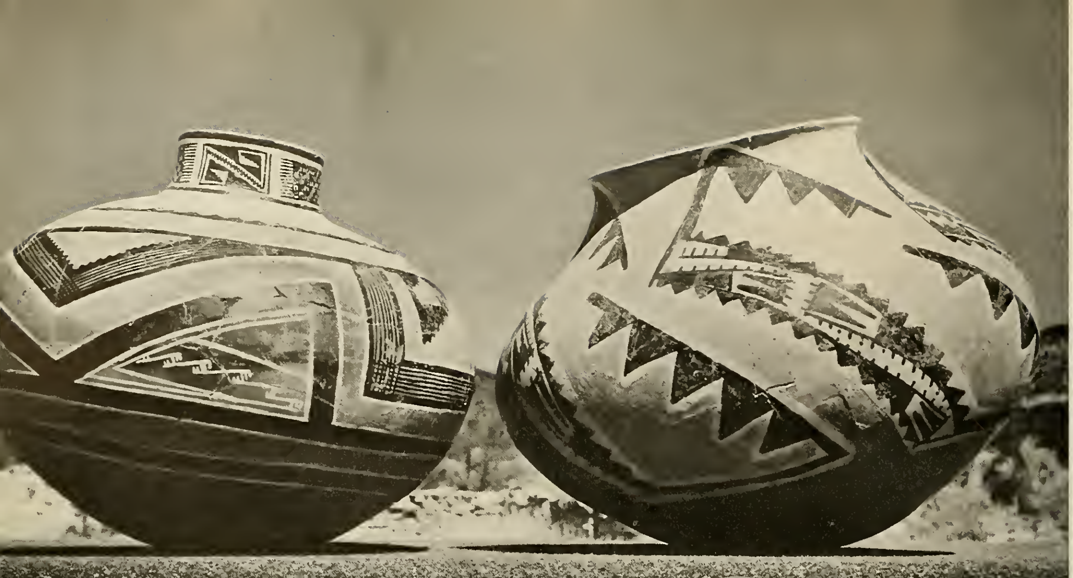
► A TURKEY BOWL, at least 600 years old and probably older: an original Kinishba creation, artfully decorated in polychrome

many rooms were found articles of religious import that must have been used by the priests. The Hopis suggest darkly that in the falling away from early beliefs may lie the reason for the final downfall of Kinishba and its eventual desertion. Another Sodom and Gomorrah!

If the artifacts, so painstakingly recovered and restored, could be safely placed where they were found, the picture of this early people would be far more realistic. But it would manifestly be unwise to risk these beautiful and irreplaceable things. In one room, for instance, examples of fine pottery were found. They were not complete and may have been "samples" gathered by an ambitious artist who wished to increase her own stock of designs. It may have been the same woman who made some of the most beautiful vessels now to be seen in the museum. The history of the art can be traced by a study of the water ollas, bowls, and jars. The refinement of materials and the use of decorations came gradually. In the heyday of Kinishba, religious ideas were clearly depicted on the clay, with an impressive knowledge of balance and design. One polychrome water jar is, in Dr. Cummings' opinion, as fine as anything that has come out of the Southwest. It is 14 inches in diameter and 11½ inches high, and is made of a fine paste, well fired.

Tools have been found in abundance. The stone metates on which corn was ground were too heavy to take away when the natives left. Hammers and axes that meant many hours of painstaking labor were found in many rooms. They were made of granite and diorite, and could be used to break rocks for buildings or to cut timbers for roofs and supports. Many of these old wooden supports are left standing and some are still buried under the buildings of our modern Kinishba. Our modern phrase, "Time is of the essence," was entirely foreign to their way of thinking. Perhaps they welcomed tasks that would fill in the long hours of inclement weather, or of the wintry seasons when cultivation of their fields was impossible, hunting difficult, and all of their time "leisure."

These people made numerous ornaments, some of which would be well received on the shelves of a modern jewelry store. Two particularly beautiful pendants are believed to have adorned the garment of some high priest. The largest of



▲ ANCIENT WATER OLLAS from Kinishba, showing the high degree of artistry that had been reached by the prehistoric people. Left-hand jar is typical of east-central Arizona

➤ PREHISTORIC FETISH: a strange "cosmic being" carved in soapstone by some forgotten artist, who drilled a hole through the neck so the charm could be worn as a pendant

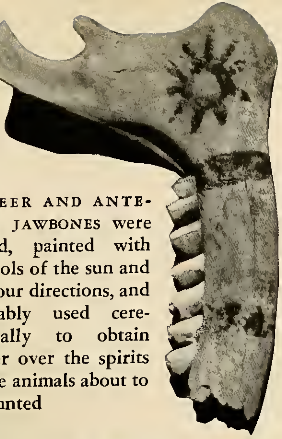
these is now at the Arizona Museum; and the smaller one is at the Kinishba Museum and is shown in one of the photographs. It was made by setting many small pieces of turquoise on the surface of a small bivalve shell by means of pine or juniper resin mixed with clay, with a central rectangle of abalone shell. A hole, drilled near the hinge of the shell enabled the wearer to hang it around his neck.

The beads were works of art, too. Several strings, found in each case in a child's grave, represent the skill and everlasting patience of some artisan. There are 17,110 tiny beads of shale and pipestone, so small that it takes about 50 to measure an inch. They were shaped by use of sand and water on stone, and are remarkably symmetrical and uniform. It takes the finest cambric needle on the market today to string them, and it was puzzling to know how these people could have found a drill fine enough to pierce them. Certainly no stone could serve. Experimentation proved that a yucca point hardened in fire might have been used. One cannot accuse these people of lacking the finer feelings, in view of the maternal devotion that prompted the creation of so exquisite an ornament for a beloved child.

Many other objects that were evidently meant for ceremonial purposes were designed to last forever. Such is the large stone tablet that measures 36 inches by 16, and ½ inch thick. It depicts on its flat surface the formalized picture of a priest with a headdress of clouds and the face of the sun on his mask. Above either hand is the symbol of lightning. The jawbones of deer and antelope were decorated with designs that may have been intended to help gain control of the spirits of the animals about to be hunted.

It is interesting to note here that the weapons were all evidently for use only in hunting and not for warfare with other men. Entirely missing in this prehistoric picture is any sign of the necessity for defense of the community or of the desire for offensive battle.

All in all, the scene at Kinishba, the Brown House, leads us gently back to a period where life was leisurely and calm. There was work to be done; life was always a struggle, but it was no mad rush. There was time for the good things of life,



↗ Deer and antelope jawbones were found, painted with symbols of the sun and the four directions, and probably used ceremonially to obtain power over the spirits of the animals about to be hunted

↓ A 15-inch bowl from long ago, found at Kinishba but characteristic also of other parts of Arizona

↑ The excavations have yielded over 17,000 tiny beads, each carefully fashioned and drilled. They are made from catlinite and dark slate, and average 50 to the inch

↑ Sandals that trod the deserts of Arizona centuries before the first white man. They are made mostly from yucca fiber, a plant that served the vanished people in many ways

for the gathering of food, and for worship at a common altar. Possessions were few and were acquired by labor and one's own skill.

Did the last survivors of the placid pueblo way of life turn for one last look, as they gathered up their bundles to start for some other distant spot? The peace of the valley must surely have pulled at their heart strings. It had been a good life, in a beautiful land. The handicraft that they left in those low rooms would, hundreds of years later, puzzle those who found it. The ancient people left no names, for they wrote nothing down. We may never know what kinds of sounds went into their language and what beautiful ceremonies took place in that patio. But they left enough for such tireless individuals as Byron Cummings to be able to reconstruct some of the faded history of Kinishba, enough to know that there were no jails here, no bitter feuds that left stone axes imbedded in enemy skulls. These early Americans may have loved this free land even as we do and counted themselves blessed to have lived here.

The fertile soil of the White River Valley is tilled now by the Apaches. They live in shelters of logs and branches, covered with canvas. They look upon the ruins as a haunted place. But some of the men have worked faithfully on the restoration, and Dr. Cummings tells us that there are few on the reservation who have not visited the museum.

He has been able to add to the exhibits various pieces of modern handicraft made by the Indians. More colorful than the ancient things, they include bright beadwork and baskets, purses and headbands. But looking at their brown faces, weather-beaten and inscrutable, we know that it was another people that lived here and left. They were agriculturalists, settled and much more advanced in their culture than the modern natives of the region. From the latter, who come to get water at the faucets fed by the white man's windmill, we can get no answers to our questions about the dwellers of Kinishba. When the last survivor of Kinishba took his family from the shade of the brown walls, he left forever, and with him went a way of life.

Flowers
from the wilderness to your garden

By Henry K. Svenson

Curator of the Herbarium, Brooklyn Botanic Garden

Color photographs by Frederick W. Cassebeer. *Drawings by* Richard Crist
Drawings of iris by Louise Mansfield

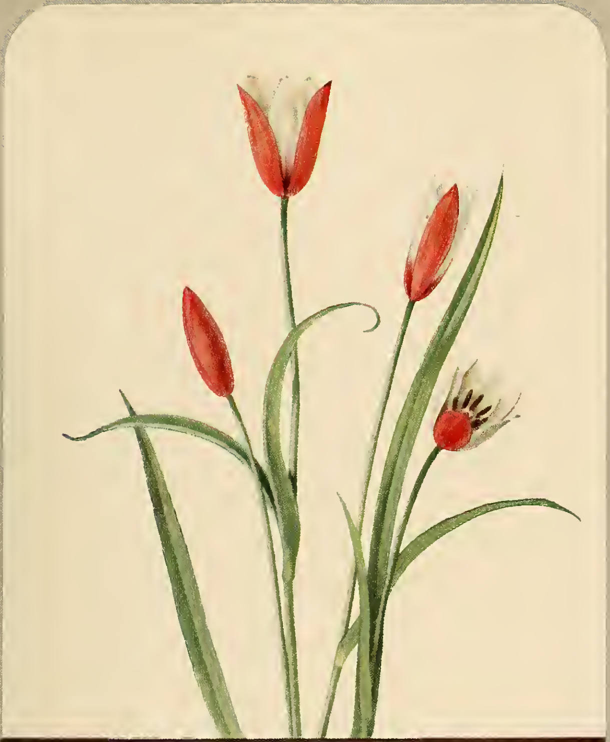
GARDENERS, both amateur and professional, have at least one thing in common, and that is an interest in the historical background of the plants they are growing.

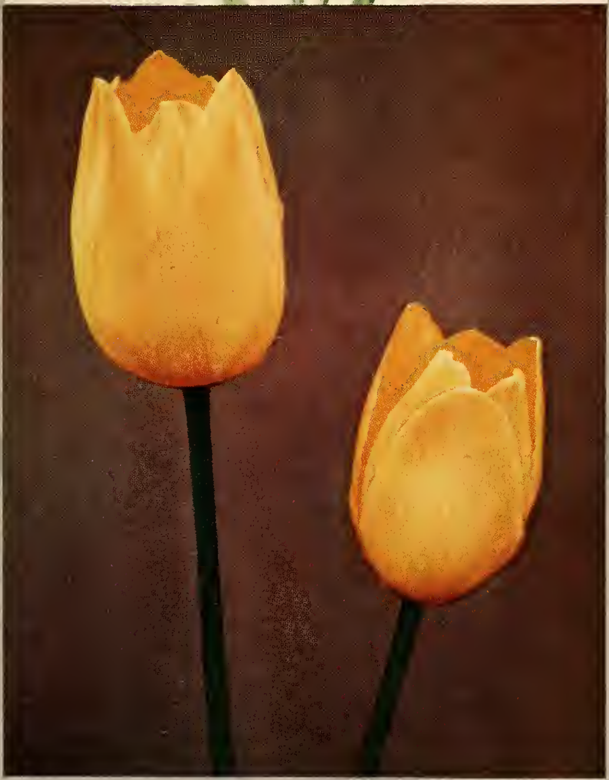
As E. D. Merrill, Director of the Arnold Arboretum, has said, "the advances which we have made in plants and animals are as nothing compared with the work of our prehistoric ancestors in taming these." Yet the story of our commonest garden flowers is largely veiled in mystery, perhaps because these flowers are the ones that have grown up with the civilization of man, himself. Their history is often lost in the horticultural processes of the sixteenth and seventeenth centuries. Even the records of the eighteenth and nineteenth centuries are often obscure or wanting, for the important change is often not recognized until long after it has taken place.

What a surprise these plants bring us! We have attempted to show in Kodachrome some of the modern examples, and as nearly as possible the wild types or early cultivated types from which these modern forms may have come. The history of cultivated fruits and flowers marches along with the history of civilization, and we can reach back only as far as history will allow us.

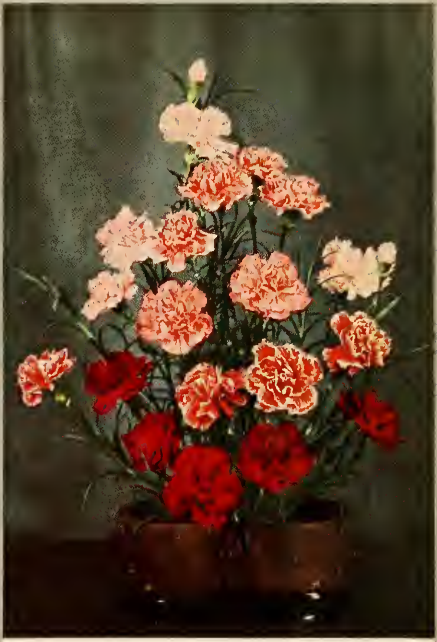
Consider the tulip. Its development has been recounted in detail by A. D. Hall in his remarkable work on the genus *Tulipa* (1940). He mentions a letter from Busbecq, the famous Flemish diplomat, archaeologist, and naturalist, who traveled to Turkey on a diplomatic mission in 1585. "Having delayed at Adrianople one day," Busbecq writes, "we were going on toward Constantinople . . . and as we were passing through the district an abundance of flowers was everywhere offered to us—narcissus, hyacinths, and those which the Turks

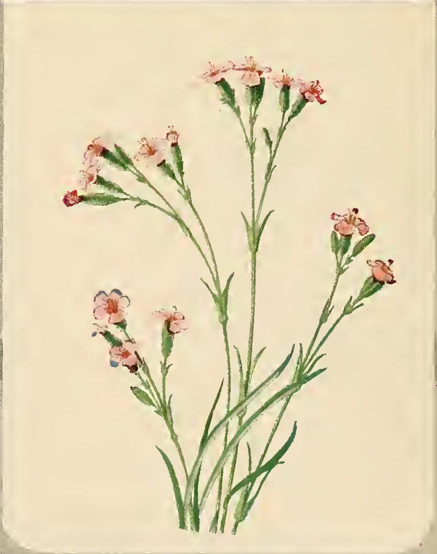
Scientific breeding and natural selection through the ages have produced our gardens — panoramas of fragrant and graceful flowers





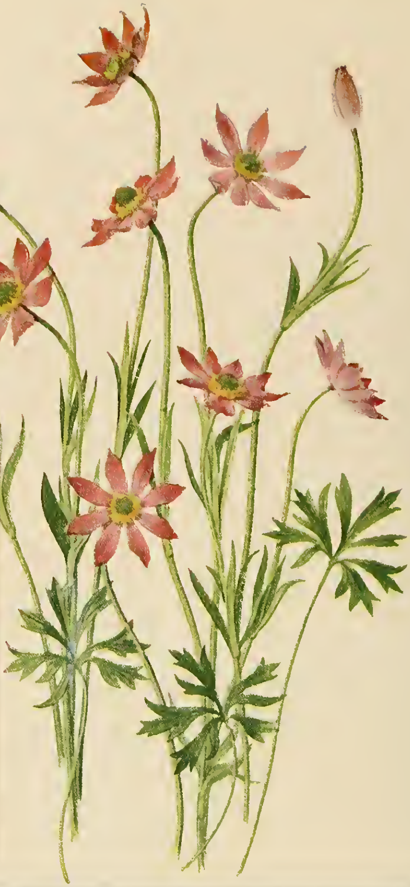
↙ Tulips were apparently first cultivated by the Turks from wild Asiatic species that were larger than the one illustrated at left, *T. Clusiana.* At lower left is shown the handsome cultivated variety known as "Belle Jaune." Large tulips in a wide variety of colors are available today



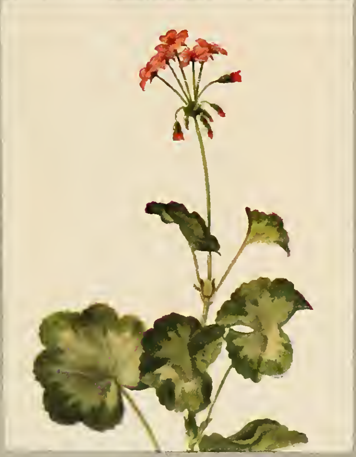


▲ Cultivated carnations (*at top*) are much larger than wild ones (*below*). Carnations were seen by Europeans in Tunis in 1270, and were brought to Europe by the Crusaders. The carnation early won favor for its supposed healing properties. It became a favorite adornment in portraits, and by 1671 at least 81 varieties had been named

➤ ONE OF THE PRIMITIVE ANEMONES (*A. fulgens*) from which our modern ones have been bred. Cultivated anemones were imported from Constantinople to Europe as early as 1587

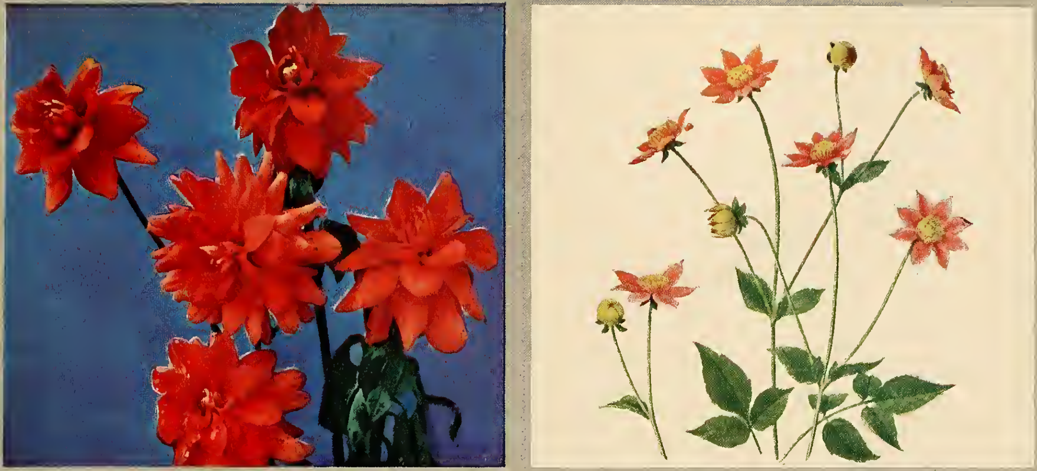


⮟ CENTURIES of effort in plant breeding go into the modern seed package which produces spectacular anemones like those shown below

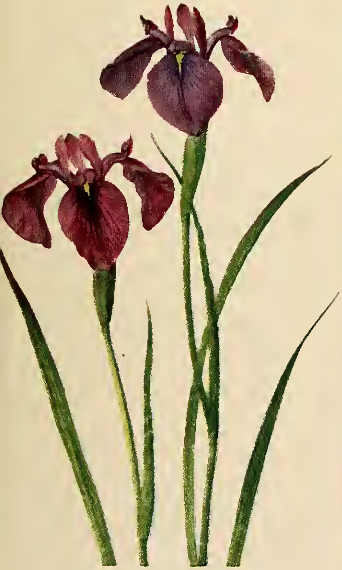


⮜ THIS PRIMITIVE RED GERANIUM gives an idea of the wild prototype. Wild geraniums are known in America and Europe, but the dry regions of South Africa gave us the two direct ancestors, which were known in England by 1714

➤ MUCH of the early improvement in the geranium through cross-fertilization was effected by two amateurs, Edmund Foster and the Rev. Garth

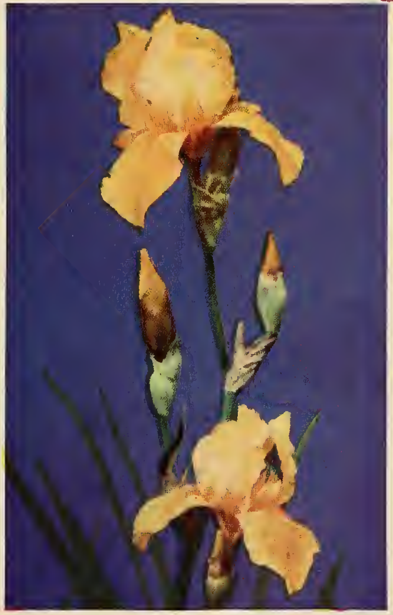


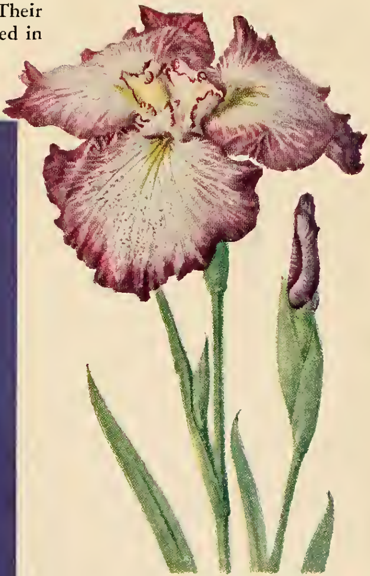
▲ Cultivated dahlias, like the "Coralette" above, show great beauty and variability. Mexico was the country of their origin. The Indians had already been cultivating them a long time when the Spaniards introduced them to Europe more than a century ago



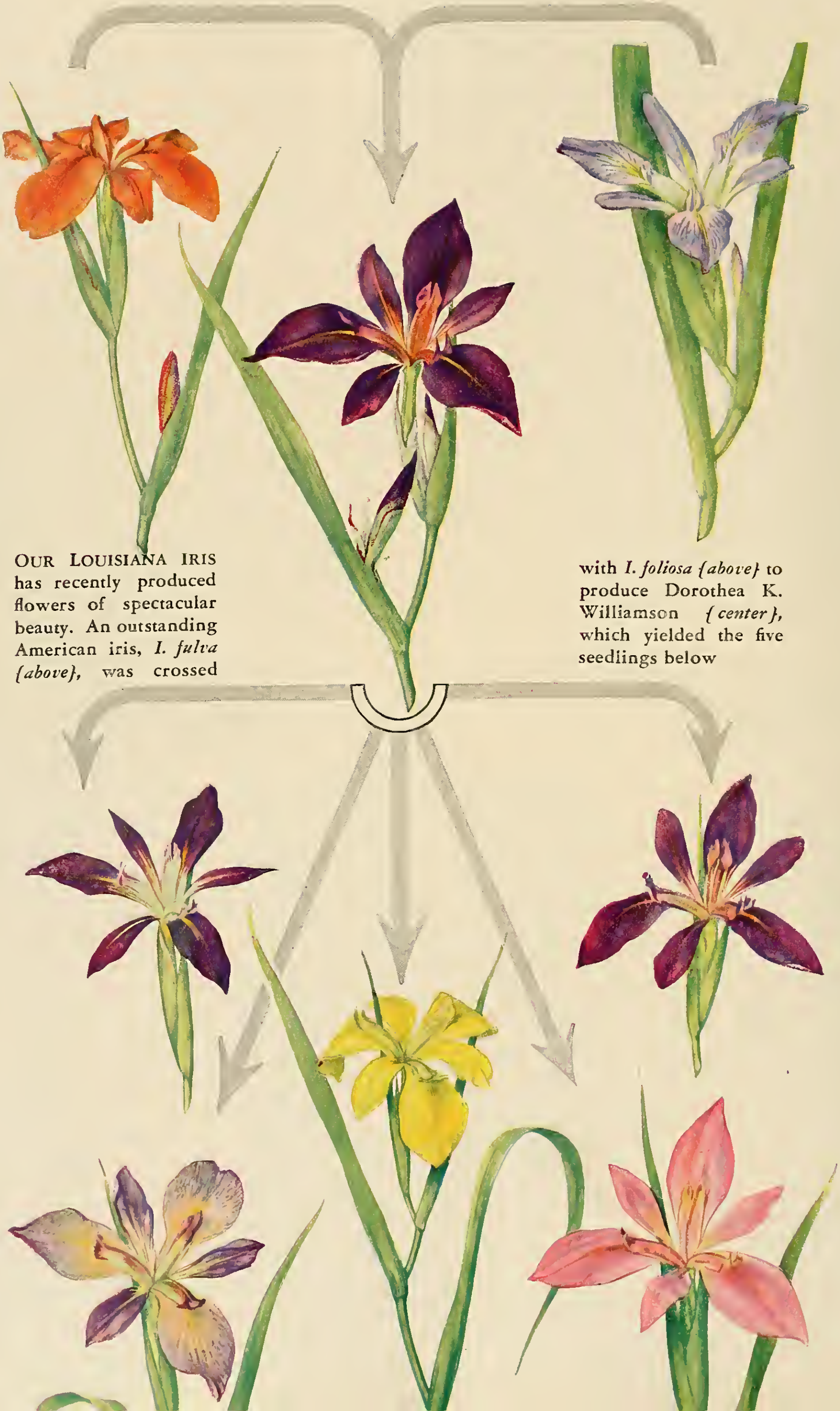
▲ The wild Japanese iris. About 100 other species of wild iris are known; this one has been developed almost as much as the Common European iris

(*Center below*) A beardless iris known as "Gayoso," one of the numerous varieties developed from the wild iris of Japan (*Iris Kaempferi*). Their full history is obscure. The first plants flowered in Europe in 1857





▲ The flower breeder's ability to increase size and beauty is well shown by this cultivated red-bordered Japanese iris, named Akafukurin, in comparison with its wild ancestor opposite

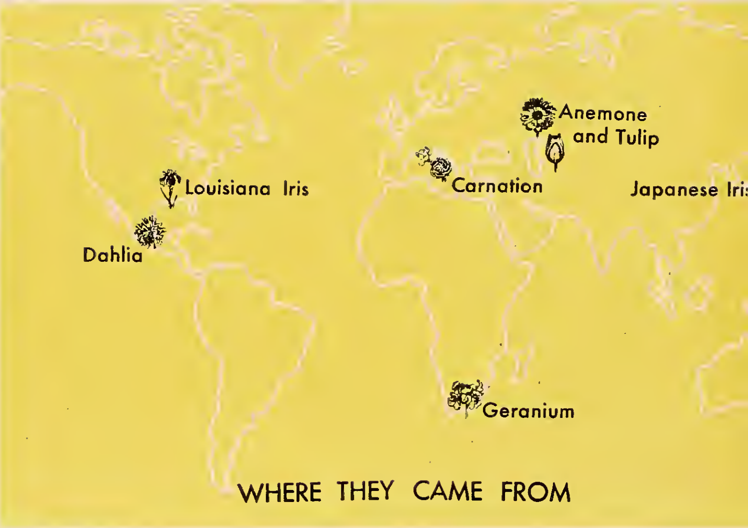


OUR LOUISIANA IRIS has recently produced flowers of spectacular beauty. An outstanding American iris, *I. fulva* *{above}*, was crossed with *I. foliosa {above}* to produce Dorothea K. Williamson *{center}*, which yielded the five seedlings below call ‘Tulipan,’ much to our wonderment, because of the time of year, it being almost the middle of winter . . . Scent in tulips is either wanting or very slight; they are admired for the variety and beauty of their flowers. The Turks cultivate flowers with extreme zeal, and though they are a careful people, do not hesitate to pay a considerable sum for an exceptional flower.”

Busbecq sent back tulips by way of Vienna, so it is seen that this first definite recorded account of the tulip was of a plant already long under cultivation. Busbecq is said to have been responsible also for the introduction of the horse chestnut and the lilac into Europe. Clusius, in his well-known *History of Plants* says that he got tulips from Busbecq in 1573.

Early Italian pictures show no indication of the tulip before the middle of the sixteenth century, though wild flowers are often beautifully depicted, nor does the tulip appear in Persian art earlier than the sixteenth century. But one reads in the recently published eighth volume of *Chronica Botanica,* in which there is an interesting portrait of Busbecq, “One should not lose sight of the fact that Busbecq’s mission to Constantinople was not the first, and that there had been many contacts, commercial and diplomatic, between Turkey and Central and Western Europe, mostly via Venice, in spite of the wars. From the period 1520-1566 it is known that there was an extensive export trade in seeds and bulbs of oriental ornamental plants into the Low Countries, and so the tulip may also have come in this way.” Gesner first saw tulip flowers at Augsburg, in 1559, and since these were reported to have been grown from seed, they may have been earlier than Busbecq’s introduction. These references emphasize the fact that our knowledge of the origin of many cultivated plants is bound up with our better understanding of the early sixteenth century contacts between Europe and western Asia.

These tulips were presumably all of the group known as *Tulipa Gesneriana* although *Tulipa Clusiana,* a wild species of eastern origin and known as the Persian tulip, was familiar to early botanists. The latter is very much like our illustration of a wild tulip on page 121 with red outer sepals. This gives us an idea of how one of the wild species looked. The cultivated tulip (*T. Gesneriana*) could not do this, for it was a reddish tulip with yellow center and is not known in the wild state. But the appearance of the ancestral wild tulip can be surmised from the simple reddish tulips with which we are all familiar, though even these were the product of long cultivation. Over a hundred species of tulip are now known, chiefly as a result of the Russian exploration of Turkestan and other parts of Central Asia, and some of these wild tulips are now among the most handsome adornments of our gardens. The cultivated forms of *Tulipa Gesneriana* have been crossed and recrossed, and cultivated by selection both from seeds and bulbs. They vary in a few years of cultivation so that their direct parentage becomes unrecognizable. Seeds require seven years to flower; the best plants are selected and known as “breeder tulips.” They are single-colored plants, but probably due to virus disease the progeny after an indefinite period “break” to produce the variegated forms which the plant breeder seeks. “Cottage tulips” are so called because they were first found in old cottage gardens. “Darwin tulips” are a distinct race, with a wide range of colors but no yellows. “Parrot tulips” have curiously striped flowers, and have been grown since 1665, but their origin is not known. During the height of the tulip craze (readers will remember *The Black Tulip,* a novel by Alexandre Dumas) a single tulip of the variety *Semper Augustus* was sold for over $1,000. Now, much more beautiful tulips can be bought for an insignificant fraction of that sum.



The anemone, like the tulip, had undergone extensive cultivation by the Turks, and the two species, *Anemone coronaria* the “Poppy Anemone,” (with finely cut leaves), and *Anemone hortensis,* (with coarser leaves), were already in cultivation by Gerard in 1597. To complicate matters, there is a third kind, *Anemone fulgens,* which is often considered as only a variety of *A. hortensis,* of which a rather primitive form is shown in our illustration. Gerard explains that the name "Anemone," literally "wind flower," was used in Pliny's day, in the belief that this flower would never open by itself but only when the wind blows. There is some question as to whether the name does not rather have some mythological signficance, but at any rate the history of the anemone is closely intertwined with that of the tulip.

Gerard mentions that plants with small jagged leaves and double flowers were called *Galipoli lalé*. It is interesting to note that "lalé was also the Turkish name for the tulip. The term "tulipa," which referred to a "turban," was in some way confused by Busbecq and other early visitors to Constantinople. Clusius describes many kinds of anemone. He speaks of buying anemones from Constantinople in 1587. To quote him, "A tenth kind of Anemone I have from Constantinople, by the generosity of Dr. Heusenstein, which was conspicuous in his garden in April 1587, of which he gave me a fragment in the succeeding July, and finally among the broad-leaved anemones which have a purple flower, Joannes Boisot has sent seeds in the year 1598." Clusius notes also, "That Nature not less produces colors in the flowers of these plants than in Tulips and Iris."

Already in the seventeenth century, these anemones had achieved a complexity that defied classification. Linnaeus in his sumptuous account of Cliffort's Garden (1737) mentions that the tuberous-rooted anemones vary "in color and fulness of flowers in a thousand ways," and quotes his predecessor Morison: "To assign all these as varieties, according to the largeness and smallness of flowers and their diverse colors, is an infinite labor; for Nature displays her variation in this species, as much as in Tulip, Narcissus, Ranunculus, Dianthus, and many other species . . . so that to know them, since new varieties arise from time to time in the sowing of seeds, is to roll the rock of Sisiphus." Sisiphus, it may be recalled, was the son of Aeolus, and his punishment in the infernal regions was to roll uphill a stone which kept constantly rolling back. *Anemone coronaria* differs from *Anemone hortensis* in having rounded petals and finely cut leaves. It grows abundantly in the Holy Land, and by some it is thought to have been the original "lily of Solomon."

Carnation

Oldest, or at least best-known historically, is the plant we call the "carnation." It and the very recent Louisiana iris are the only ones in our present list of which we have a direct history. As Kronfeld (1913) says in his account of the carnation —an account remarkable for its treatment of the field of art as well as horticulture—"it is a child of the sunny Mediterranean, where it grows naturally on stony ground, exposed to the blazing sunlight, often hanging from old walls, and with few, always reddish single flowers." Our illustration was drawn from a plant with slightly double flowers, and therefore perhaps from one of the semiwild forms scattered through western Europe by the agency of man. At what time the carnation came to England is unknown; perhaps it is as old as the Norman invasion.

Dianthus ("Flower of the Gods") perhaps due to the brilliant color of several of the Mediterranean species, was used for wreaths in ancient times. *Dianthus caryophyllus,* the carnation, has always been associated with the odor of the clove (*Caryophyllus* of the Greeks), which was known to western Europe at a very early date through the activities of the Arabian and Greek merchants and their Far-Eastern caravans. Although Saint Hildegard (1098-1179) knew the clove, she had no record of the carnation in her garden.

The French name of the carnation is *oeillet* or "little eye," because in one of Ovid's stories, Diana, meeting up with a shepherd during a hunting trip, literally knocked his eye out. Suffering from remorse, she had the eye converted into the flower we know as the carnation, and it is said that one can see the replica of the human eye in the center of the flower.

It is thought that the carnation came as a cultivated plant from Mediterranean North Africa. At least in 1270, the unfortunate troops of Louis IX of France obtained in Tunis a liquor flavored by the flowers of the carnation, memorable in a pestilence-ridden land. The plant was already being grown in North Africa for this purpose. The king thought that this plant, with a smell similar to that of the costly oriental cloves, must of necessity be of great medicinal value. It was transported through Europe by the Crusaders and soon was greatly prized for its wonderful healing juice. Thus the story of the carnation begins with its properties as a medicine, and the beautiful color of the flowers added to its popularity. It was thought to be good for almost every kind of disease. Kronfeld cites a costly recipe for heart trouble for the Duchess Eleonora Maria in 1710: "First take one or two citrons, according to size, and cut them up finely, then take rosemary, borage, and yellow violets, as much of one as of the other, and put them in a glass; pour a good muscatel, or any other strong wine on it, and let it brew for 1 or 2 days; then the carnation julep is made as follows: take a pint of water, mix a pound of sugar with it, and let it dissolve; then put in six ounces of beautiful red carnations cut up; then place it in a stone crock, then take the juice from two lemons, let it seethe twice, and put it into a glass to which 3 grains of musk or amber are well grated and stirred in. When a person is weak a little is taken; also spread on a scarlet cloth and placed over the heart. Those who cannot stand the musk or amber can leave it out."

The carnation became known as the "Flower of the Renaissance," and with the revival of the arts of Greece and Rome, it was cultivated by the wealthy in their gardens. It is a prominent feature in the paintings of the fifteenth and sixteenth centuries. Up to the middle of the fifteenth century it was certainly a rare flower in northern Europe, for only a rare flower would have received such care from both the gardener and the artist. In early pictures of gardens, the carnation is always shown growing in pots with the stems supported by trellis-like structures. In many portraits the subject holds a carnation, particularly in Italian pictures, but also in England as early as 1463, in a representation of King Edward IV.

Carnations were grown both from seeds and from cuttings. By 1542 Fuchsius already knew red, white, and varicolored carnations, some double-flowered. Bock (1546) writes: "The Grassflower we find both wild and tame, single and double, and of numerous colors: some are white, some almost black or blood-red; furthermore, one finds them with mixed colors, as red and white, often with many variations; one finds also flowers with red spots, and sometimes flowers of different color on the same stalk." And Gesner noted that the flowers may be of many colors and sizes and that "they are not accustomed to be grown from seeds, but from 'surculi' (cuttings)." Darwin found the carnation a good example of variations and thought that many of the forms were due to bud-variations.

By 1671, Reichenbach had listed 81 named varieties of the carnation, and such names as "The Admiral of Holland," "The Vice-Admiral," "The White Swan," and "The Little Princess," show that the naming of flowers for celebrities and pseudo-celebrities had started long ago.

The greatest single step in the history of the carnation was the development of the everblooming greenhouse type in Lyons, France, in 1835. Dalmais, a gardener on an estate, produced a fine carnation by hybridization. The descendants proved constant, and by 1842 he had 15 or 20 fine carnations. In 1845 he made a new sowing, and from these have come the elegant varieties now cultivated everywhere, with flowers appearing successively on the stalks. Lille, a gardener in Lyons, began selling seeds, and soon this type of carnation became widespread.

Two of the cultivated plants we have been discussing originated in Asia, the third in the Mediterranean region. In the case of the geranium, we move to South Africa. Species of geranium are known in Europe and we have a "wild geranium" as a common plant of eastern United States. The geraniums of South Africa became known very early as *Pelargonium* and as L. H. Bailey says in his *Cyclopedia of Horticulture,* "The person who wishes to study the contemporaneous evolution of plants may find his heart's desire in Pelargonium. With great numbers of species and many of them variable and confusing in a wild state, with plant breeding in many places and continued through two centuries, and with a large special literature, the genus offers exceptional advantages and perplexities to the student. Most of the species came into cultivation by the English and Dutch."

As early as 1714, the two original species, from which the ordinary garden geranium has been derived, were known in England, having come from dry bushy places in South Africa. These two geraniums were known as *Pelargonium zonale* and *Pelargonium inquinans.* These plants were known to Linnaeus in 1753 chiefly from earlier descriptions and the drawings of Dillenius, a predecessor of Linnaeus, show that the garden geraniums had already varied greatly. So complicated has the history become that Bailey has introduced the new name "*Pelargonium hortorum*" for our red household geraniums, an admission that their history is so snarled up as to be practically inextricable. We have shown in the illustration on page 122, one of the primitive red geraniums. As Bailey states, "it had been greatly modified by domestication by 1753," and "there is no accepted portrait of the original form of the plant." By the middle of the nineteenth century, much of the change in the plant, as we now see it, had been accomplished, and in the *Gardener's Chronicle* for 1841 we read, "The great improvements that have been achieved within a few years in the properties of this flower, and the splendid varieties we now possess, bear triumphant evidence of the advantages to be derived from judicious cross-fertilization. The long narrow flimsy petals of the old varieties . . . have been succeeded by the beautiful compact flowers of the present day, with broad stout petals.

"In these improvements we are chiefly indebted to the zeal and perseverance of two amateurs—Edmund Foster and the Rev. Mr. Garth—whose love of Floriculture has induced them to devote their time and attention to the delightful occupation of effecting such further improvement as this flower is still susceptible of. The success of these gentlemen has called forth numerous competitors in the same field; and every year many new varieties are introduced for public patronage. It is therefore necessary for purchasers to exercise some discrimination in the selection of such kinds only as will stand the test of floral criticism."

The interest in geraniums has to a large extent subsided. It reached its height in the early part of the nineteenth century, and centered largely about the show or greenhouse geraniums, for the common or bedding plants had not yet reached great popularity.

For a knowledge of the history of the dahlia, we are indebted to the account by Dr. George T. Moore, Director of the Missouri Botanical Garden, in his *Bulletin* (1929). It seems that the dahlia has been known for over 300 years, for the plant was well illustrated by Hernandez, in 1615. Hernandez was physician for Philip II of Spain, and after visiting Mexico he described a plant "with flower stalks nine inches long, and pale red, star-shaped flowers." But it is quite evident that the plant had been under cultivation by the native Mexicans for a long time, since plants differed from one another in size and color of flower. Some were "white, others yellow, others purple or yellow tinged

Continued on page 146

MINERAL MASQUERADE

An unusual series of photographs of objects that resemble things they are not

Cranbrook Institute of Science Photos, from Three Lions

➤ **Alert Fox Terrier**: garnets in mica. Red garnets make his nose and eyes

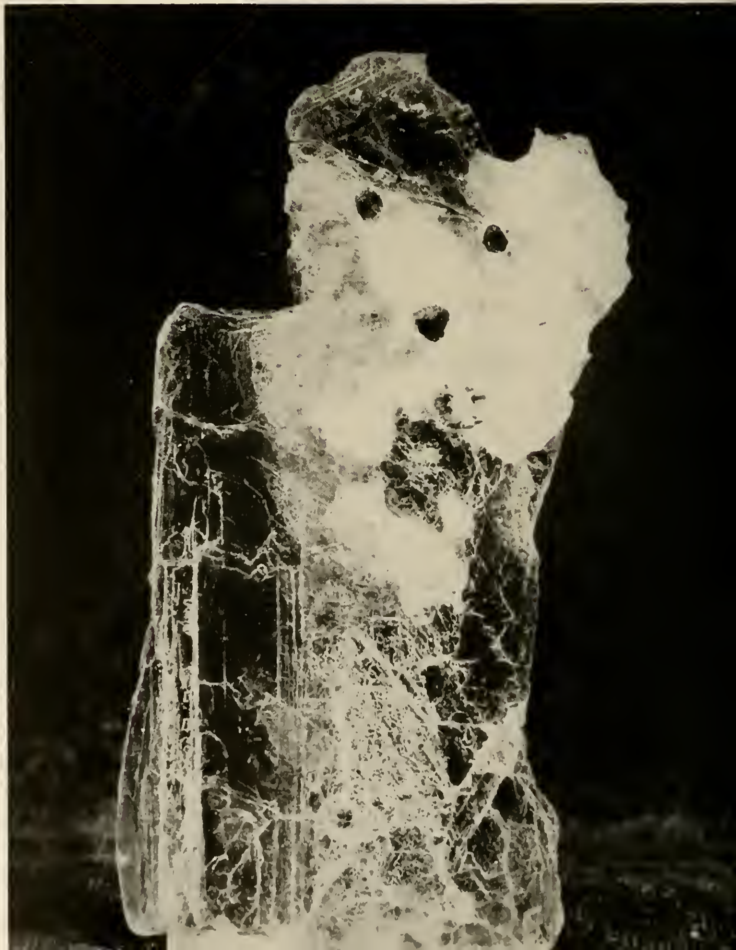


Photo by Harvey Croze

▼ **Seal Pup**: Chalcedony stalactite

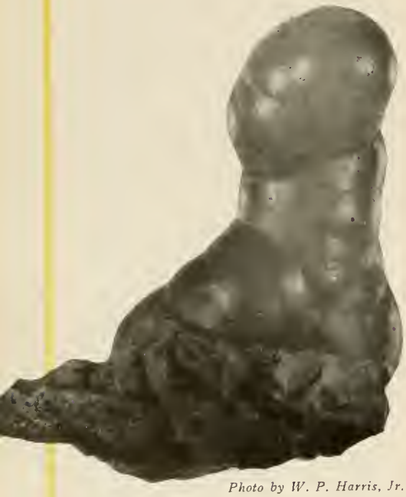


Photo by W. P. Harris, Jr.

▼ **Conceited Pup**: agate geode

Photo by W. P. Harris, Jr.

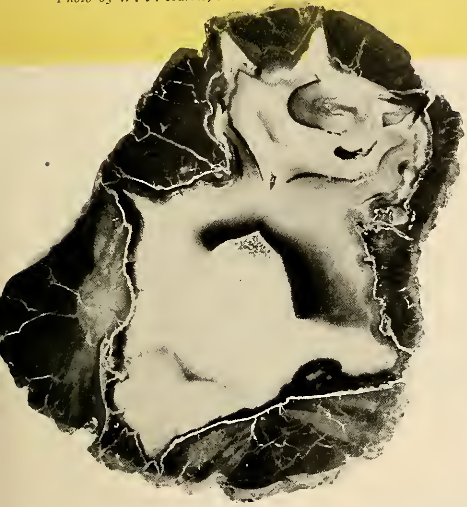
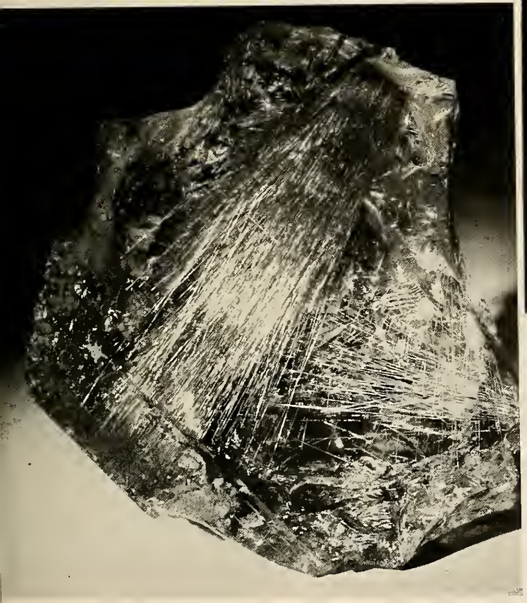


Photo by Cranbrook Institute of Science



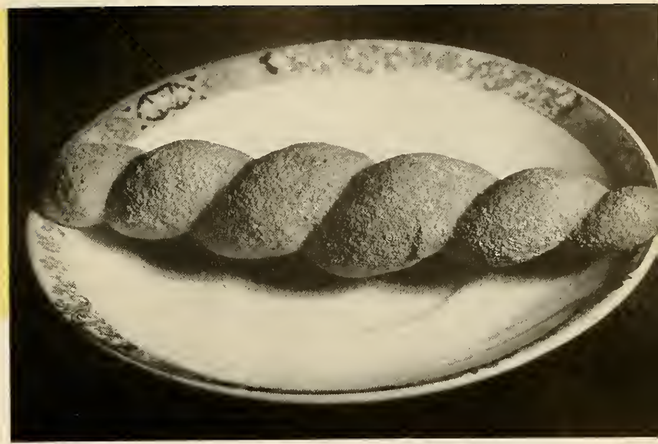


Photo by Horvey Croze

▲ **Vienna Salt Roll**: a sandstone concretion

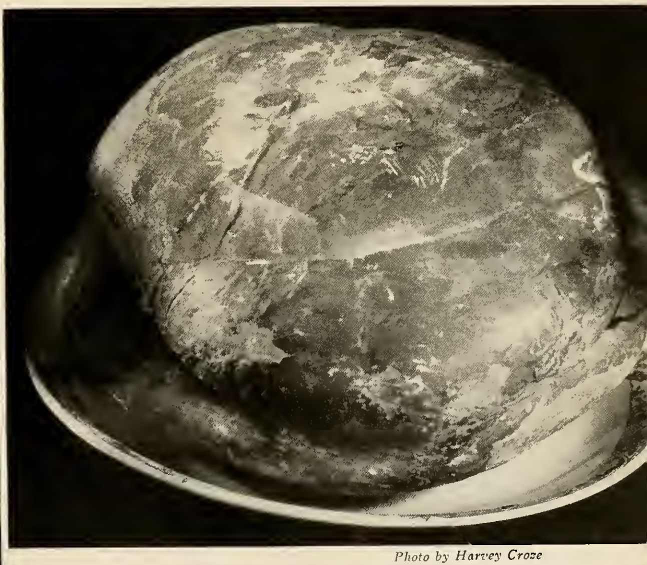


Photo by Harvey Croze

▲ **Frankfurter in Bun**: mudstone concretion

◀ **Tracer Bullet Pattern**: rutile crystals in quartz, from Brazil

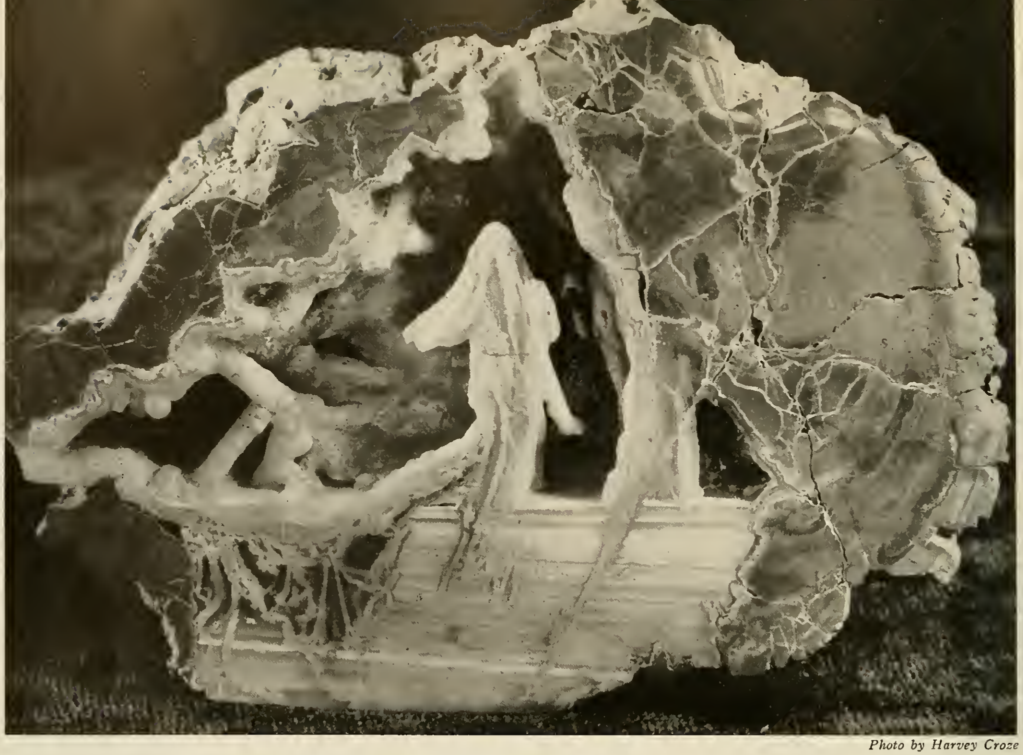
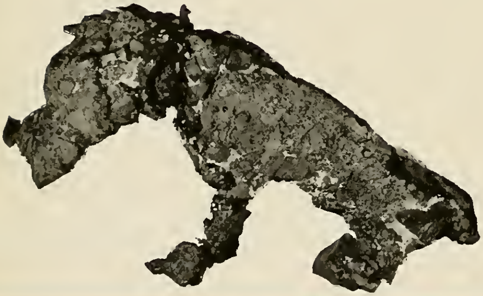


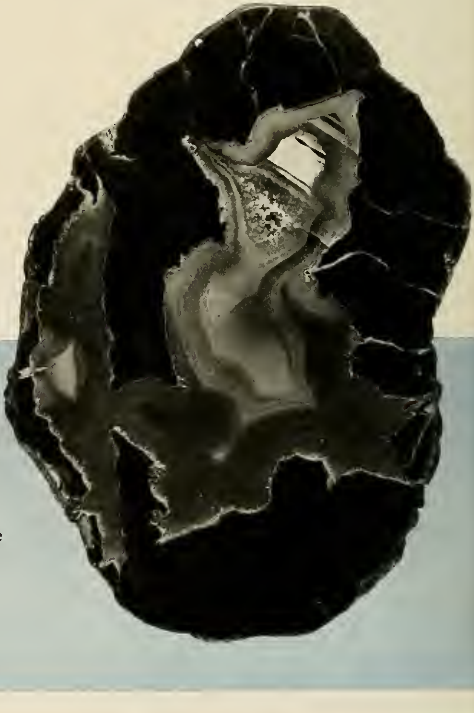
Photo by Harvey Croze

▲ A LADY OF AGATE steps into the garden from her pavilion: an agate geode from Oregon



▲ A DOG IN MICHIGAN COPPER, too tired to shake a fly from his nose

Photo by W. P. Harris, Jr.



➤ WOODPECKER ALIGHTING: agate geode

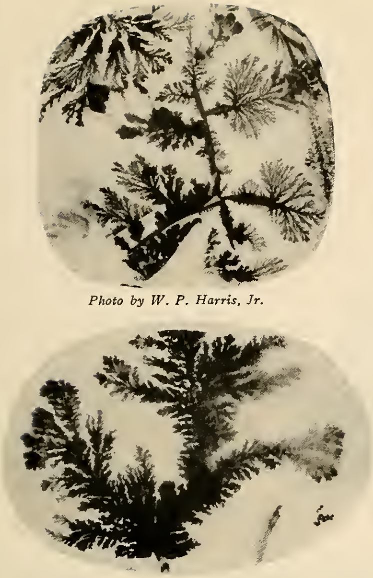


Photo by W. P. Harris, Jr.

▲ **Moss or Water Plants**: manganese in quartz, from India

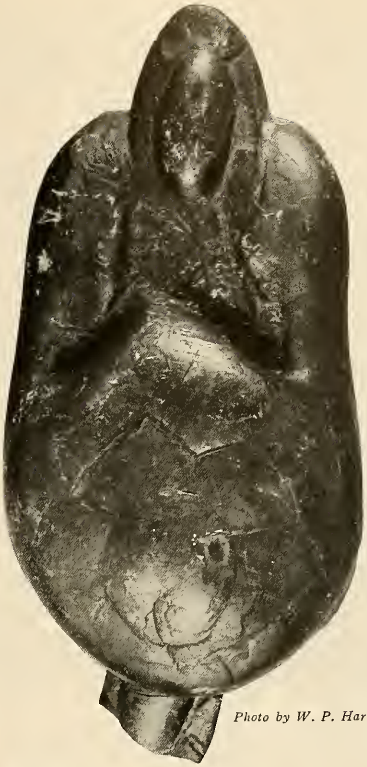
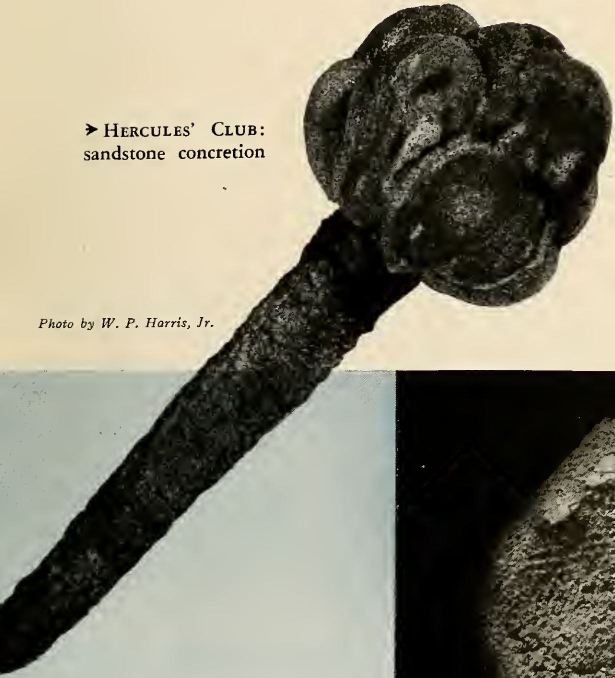


Photo by W. P. Harris, Jr.

▲ **Buddha**: a mudstone concretion

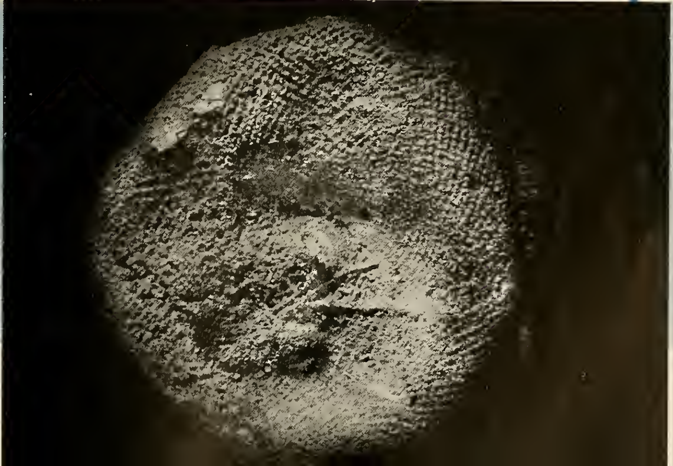


➤ **Hercules' Club**: sandstone concretion

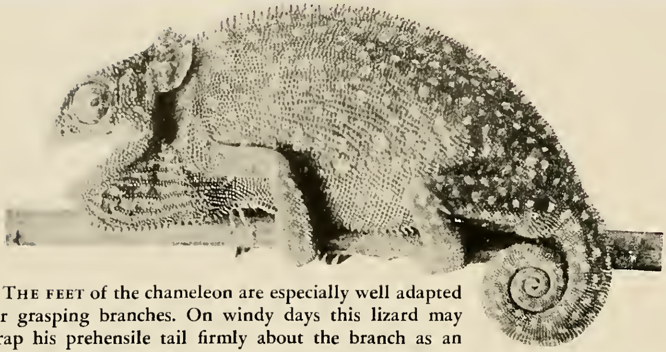
Photo by W. P. Harris, Jr.

▼ **Sunflower Head**: a fossil sponge

Photo by Harvey Croze



AFRICAN CHAMELEONS



▲ THE FEET of the chameleon are especially well adapted for grasping branches. On windy days this lizard may wrap his prehensile tail firmly about the branch as an added precaution against falling. This hornless chameleon is green with orange spots (*Chameleo dilepis idjuiensis*)

Brian A. Loveridge photo

When one of the few creatures on earth with three horns has a lightning-like tongue as long as its body and can change color, is it any wonder the African native holds it in superstitious awe?

By ARTHUR LOVERIDGE
Curator of Reptiles and Amphibians at Harvard's Museum of Compartive Zoölogy

WHEN living in Kenya Colony, on my daily ride from Parklands to the Nairobi Museum, I used to encounter horned chameleons crossing the road. Naturally I picked them up and carried them on with me. Having no suitable cage in which to keep them, I provided accommodation by fastening a branch of eucalyptus gum to each one of half a dozen electric lights hanging from the ceilings of the office and the exhibition hall. When in position, the lowest twigs were about five feet from the floor, a height sufficient to deter a chameleon from jumping down. To attract flies I tied a piece of noisome meat to every branch. Then on each bough I released one or two of the somewhat sedentary reptiles.

Two chameleons were all that would be tolerated. Every time I attempted to introduce a third, the newcomer was attacked by the original pair who, open-mouthed and with unwonted haste, came striding down to meet him. On reaching the stranger the defenders halted, swaying their bodies from side to side. Usually this was sufficient to induce the late arrival to cast himself to the ground, but if he failed to do so he was promptly attacked.

The methods of attack varied. One chameleon ingeniously applied his chin to the almost vertical branch. In this position his entire armament was directed downward. Then with bayonets fixed, so to speak, he would descend upon the foe, prodding and pushing him backward and downward till the newcomer fell to the floor. At times, however, the stranger would succeed in seizing one of the defender's horns in his forefoot, and a tussle would ensue. One reptile grabbed the other's foreleg and proceeded to butt the foe with his own armored head. Another chameleon mounted his adversary's back and, digging in his claws, continued to attack from this vantage point. So determined was his grip that I had the greatest difficulty in separating the combatants. Invariably they bit each other hard.

An angry chameleon can give a startlingly unpleasant nip, but generally the crowns of its teeth are too blunt to break the skin of a human hand. Yet I well remember the concern displayed by a young Dutchman when I picked up a common chameleon (*Chameleo dilepis dilepis*) from a shrub growing on the plains at the foot of the Usambaras. Horrified at my rash act, he implored me to put it down, saying that he knew of a woman who had died from a chameleon bite! "They are poisonous," said he, "for if you put oil from a pipe stem in their mouths, chameleons die. Harmless reptiles are unaffected by the nicotine, so you can tell a poisonous snake from a harmless one by this means." Asking him where he had learned such nonsense, I popped my little finger into the chameleon's gaping mouth. The reptile clamped its jaws shut and chewed vigorously for a few seconds. The teeth marks were plainly visible on the uninjured skin when I removed my finger. Was my friend's faith shaken by this demonstration? Not in the least, he simply said that the chameleon was evidently a young one; actually it was two-thirds grown.

Though sometimes detected on bushes, most of the common chameleons I found were crossing paths or ascending the vertical trunks of rough-barked trees. When molested, the reptile assumes a menacing attitude to frighten the disturber of its peace. The flaps on either side of the head behind the casque are raised like the ears of a charging elephant. Simultaneously the mouth gapes widely to reveal its red interior, and the throat is dilated until the orange-colored interstitial skin shows up between the rows of black scales. Then the chameleon, hissing loudly, makes a forward lunge with such startling suddenness that one instinctively recoils though cognizant of the creature's absolute harmlessness.

Usually the display is accompanied by inflation of the body, for which the unusual lungs are well adapted. Instead of being simple bags, they continue downward and backward in long finger-like sacs, so that their inflation causes the entire body to assume proportions much larger than the normal. One foot, and fifteen inches, respectively are the maximum over-all lengths of the biggest male and female examples of the common East African chameleon I have measured. In each instance the tail took up approximately half of the length; even so the measurements are exceptionally large.

But a chameleon's chief defense, and the one that has caught popular fancy, is its passive practice of camouflage. Through their ability to change color so as to conform more or less to their surroundings they have become world-famous. Many people, however, entertain an exaggerated conception of their powers in this respect, for there is considerable variation between different species as to the rapidity with which such changes are accomplished. Some kinds change scarcely at all or very slowly. Nor is color change confined to matching environment. When annoyed, or frightened, a chameleon will turn brown or black, and its colors are affected by sunshine, darkness, cold, heat, health, and other factors.

As most nature lovers know, these African chameleons are quite unrelated to the dainty little anoles miscalled "chameleons" in the United States. Anoles are confined to the Western Hemisphere where they occur in great variety in the West Indies as well as in Central and South America. One might add that in North America countless anoles (*Anolis carolinensis*) are annually condemned to a lingering death from starvation by parents who perpetuate the trade through purchasing these attractive little lizards to gratify their children.

Except for sharing with chameleons the ability to make rapid color changes, anoles may be dismissed by saying that they differ from the true chameleons by lacking all the peculiar characteristics that make the African reptiles so interesting. In general neither anoles nor chameleons do well in captivity if removed from the climatic conditions to which they have become adapted.

The outer scarf skin of African chameleons is colorless and semitransparent. It is not unusual to come upon a chameleon in the process of discarding this cuticle. Ragged fragments, like scraps of tissue paper, which may still adhere to it, often give the reptile a ridiculous appearance. Below this layer is one in which some iridescent cells are embedded; and below this again are many cells containing granules, chiefly crystals of a strong refrac-

▼ The chameleon's club-shaped tongue is sufficient to distinguish it from all other lizards. When it is projected at the prey, the tongue is about the length and shape of a very slender pencil except for its swollen tip

A.M.N.H. photo

tive type. According to Hans Gadow, they give rise to the white in a chameleon's appearance by diffuse reflection of direct light. Other cells contain oil drops that impart a yellow appearance. By diffraction of light through these different layers, assisted by the action of the iridescent cells, light areas may be changed to green. Beneath the epidermis and yellow layer is a white one, and below this again a series of chromatophores, or pigment-bearing cells, whose fine branches extend outward through the white and yellow layers to the epidermis. When the appropriate stimulus is provided, particles of pigment—red, brown, and black—move toward the surface. When the branches contract, they are forced back into the larger basal portions of the chromatophores, causing the reptile to appear pallid. If, under nervous stimulation, the pigments are all rushed to the surface, the chameleon will appear dark or even black. In a way, the process may be compared to the involuntary flushing or blanching of the human face upon the receipt of good or bad news, though in that case the result is due to an increase or decrease of blood near the surface of the skin.

In their wild state chameleons perform a useful role by destroying insect pests. Among the Usambara Mountains of eastern Tanganyika Territory, which we visited in search of chameleons, we met a planter, who, appreciating their usefulness in keeping down beetles, had set out to install a chameleon on each of his coffee trees. To achieve this purpose he offered a trifling reward to his laborers for bringing in any chameleons they might find. This was not so simple a matter as might be supposed for most natives hold the lizards in awe, some are actually terrified by them. "See," they say, "it has an evil eye."

There certainly is something uncanny about a chameleon's eyes. The large globular eyeballs, covered by the eyelid except for a tiny aperture in the center, are capable of moving and seeing independently. This is by way of compensation for the reptile's inability to turn its head, for the backward prolongations of the boxlike skull restrict its movements by coming in contact with the spine. Consequently if someone should approach a chameleon from the side or rear when the reptile's eyes were focused forward on a fly it was stalking, one eye would be left to watch the insect while the other orbit slowly rotated to observe the potential enemy approaching from behind.

Owing to this and other attributes, chameleons figure prominently in African folklore, where they are blamed for the introduction of natural death into the world. One of the stories I heard invites attention to the chameleon's hesitant gait. For the reptile's progress, like that of a praying mantis, bears sufficient resemblance to a swaying leaf to render the greenish animal less conspicuous.

Once upon a time an elephant, meeting a chameleon, addressed the reptile as follows: "Why do you imitate my walk, hesitating over each step? There is no need for you to examine the ground before treading on it as I must do, for you are neither so heavy nor so powerful."

"On the contrary," answered the chameleon, "I am both bigger and stronger than you, though I choose to conceal the fact."

The elephant, frankly incredulous, challenged the chameleon to furnish proof, so the impudent little reptile suggested that they have a trial of strength the next day if the pachyderm would name a meeting place.

No sooner had they parted than the chameleon set out for the rendezvous and there dug a deep hole. Then with twigs and leaves he carefully roofed it over until it looked no different from the surrounding ground, yet so flimsy was the covering that it would collapse beneath the slightest strain.

When the elephant arrived, the chameleon suggested that the big fellow stamp on the ground with sufficient force to bury himself in the resulting hole. The elephant protested that he could do no such thing, and questioned the chameleon's ability to do so either. "Nothing simpler, see here," exclaimed the chameleon as, springing on the prepared spot, he disappeared from view. This unexpected exhibition of strength by a creature he had always regarded as feeble, so alarmed the elephant that he rushed away. In his reckless flight he broke a tusk. To this day, say the Africans, elephants fear chameleons and warn other animals not to be deceived by appearances for in reality chameleons are the most powerful of creatures!

When I told this story to Salimu, he smiled and capped it with a Kami tale: Once upon a time the chameleon challenged a lion to have a race. They lined up for the start, but as the lion sprang forward the reptile grabbed at the tuft of hair on the tip of his tail. The lion bounded along, with the chameleon clinging on for dear life. As the lion reached the winning post he sank down to rest, whereupon the *kangawingo*, as the Kami call the chameleon, cried out. "Look where you are lying, or you will crush me." On hearing the chameleon's voice the astonished lion was dispirited, and exclaimed: "What! Can you really outrun me?" "Of course I can," replied the cunning reptile. "As a matter of fact I have been waiting here for you to arrive."

There was a purpose in Salimu's story for it emphasized the clinging ability of a chameleon. This lizard lives almost entirely in bushes or trees, and its feet are especially adapted for grasping. Each forefoot has the first three fingers opposed to the two outer ones; on the hind foot this arrangement is reversed and the two inner toes are opposed to the three outer, making for a firmer grip. On windy days to make doubly sure, a chameleon wraps its prehensile tail firmly about the branch. Unlike the brittle tail of many lizards, which will grow again if broken off, that of a chameleon is permanent and quite muscular.

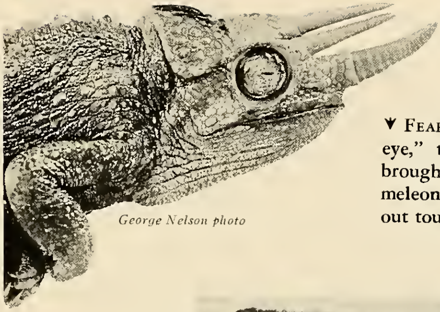
A good example of the grasping powers of these reptiles was displayed by one of the commonest kind (*C. d. dilepis*). Supposing that the animal could not possibly escape, I had released it on the spacious second-story balcony of a smooth stone house. The chameleon promptly proved me wrong by departing via the telephone wire. Just before dark I saw it clinging to the swaying wire in a high wind. The chameleon had already traveled a distance of 80 feet from the balcony and was 20 feet above the ground. The *following morning* it finished the remaining ten feet and descended a slender iron pole. I might add that I measured the 90 feet very carefully, lest my enthusiasm for the performance lead me to exaggerate the distance. If further proof of a chameleon's arboreal habits is required, it will be found in the compressed shape of the entire animal. This renders a chameleon moving along a branch less conspicuous to enemies below.

Strangest of all its peculiarities is the chameleon's club-shaped tongue, which alone is sufficient to distinguish the creature from any other lizard. Normally the tongue lies contracted in the mouth, but when its owner wishes to capture some insect, the soft tip is pressed against the roof of the mouth till covered by the sticky secretions of certain glands. Then, with a suddenness that must be seen to be appreciated, the tongue, which is as long as the chameleon's head and body together, is projected at the prey and withdrawn with the hapless insect adhering to it. At the moment of projection the tongue, except for its swollen tip, is about the length and shape of a very slender pencil. It is thrown forward somewhat in the manner that a watermelon seed can be shot from between the fingers. Circular muscles contract around a slippery tapering bone in the tongue, shooting it forward, as blood surges simultaneously into the blood vessels giving added support. Curiously enough the whole operation is slowed up if the insect is too near, then the capture more nearly resembles a licking-up process.

Centuries ago some Africans,

Brian A. Loveridge photo

▲ WELL SUITED to its arboreal habits is the compressed shape of the chameleon which renders the lizard moving along the branch less conspicuous to enemies below (*C. bitaeniatus ellioti*)



George Nelson photo

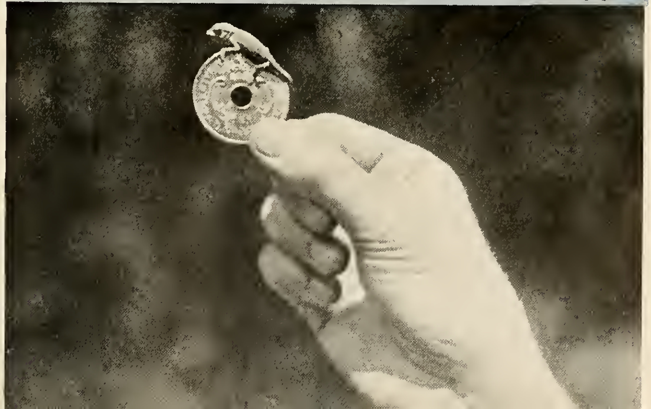
▲ JACKSON'S CHAMELEON. A Kikuyu youth as proof of his valor and devotion, will cut off one or more horns and present them to the lady of his choice

▼ FEARING their "evil eye," this native girl brought 50 horned chameleons into camp without touching a single one

Mary V. Loveridge photo

▼ A NEWLY BORN *Chameleo bitaeniatus bitaeniatus*. This is one of the few species that give birth to young instead of laying eggs

Brian A. Loveridge photo



catching a glimpse of the darting white tongue and noting the uncanny disappearance of the prey, spread the rumor that "chameleons spit poison." I have seen tangible results of this superstition in the battered corpses of chameleons lying beside native paths. It is easy to envisage the harmless reptile hesitating as, with averted eyes, some brawny giant clubs it to death with the same virtuous thoughtlessness displayed elsewhere by suburbanites who annihilate harmless, slug-eating brown snakes.

These groundless fears have been made a test for courage by the Kikuyu tribe, in whose country is found a three-horned chameleon (*C. jacksonii*) of fearsome appearance. The horns may be as much as one-and-a-half inches in length, the foremost one projecting from the snout, and another from each eyebrow. The Kikuyu youth who wishes to demonstrate his devotion to the lady of his choice, draws a sharp knife from his belt and, probably sweating with fear, slices off one or more horns. As proof of his valor he presents them to the lady, who threads the trophies on her necklace for her girl friends to admire. Again and again I have found Jackson's chameleons with truncated horns in process of regeneration, a tiny flexible point sprouting from the truncated stump.

It is scarcely necessary to say that chameleons do not raise horns just to oblige Kikuyu gallants. As the biggest horns are grown by male chameleons, those of the females being smaller or almost absent, it was long supposed that the horns were a strictly masculine exuberance. That they have a more practical use is easily testified by anyone who has seen them in use as fighting weapons as described in the opening paragraphs of this article.

The common East African chameleon is so fond of small grasshoppers that at times it forgets to masticate them thoroughly before swallowing. One day I found a chameleon hanging by a single foot from a branch. It had disgorged three sizeable grasshoppers, one of which was still kicking feebly. The spiny legs of the insects appeared capable of doing considerable damage, and I assumed that their vigorous kicking in the chameleon's stomach had killed the reptile. But as I reached for the seemingly defunct chameleon, it grasped a branch and, pulling itself up, marched off in a dignified manner!

Captive chameleons were keen on beetles and flies, eager for wood lice or sourbugs, for which they would almost run. They were very fond of slugs, but hadn't much liking for snails. Meal worms they despised. I have noticed with other species that they readily tire of meal worms. In short, chameleons like variety in their food and should have it if they are to keep healthy. During a drought when insects were unobtainable, I fed fine shreds of meat (bulbul flesh) to a chameleon. The reptile took them readily enough, but apparently they did not agree with it, for they were subsequently disgorged.

I once thought that chameleons only drank by taking dew drops from the foliage with their tongues. However, during a spell of exceptionally hot weather I found they would descend from their branches one after another to drink deeply from a bowl of water placed in their cage.

This common chameleon appears as much at home on high plateaus as in the lowland savanna and coastal plain, where the Swahili call it *kinyonga*. Most montane species are restricted to a single isolated mountain or group of mountains. East Africa, with nearly 40 different kinds of chameleons, has more than any other single area, not excepting Madagascar. Outside of Africa and Madagascar only an odd species or two occur in southern Spain, Arabia, India, and Ceylon.

One group with half a dozen species in East Africa is known as dwarf chameleons (*Brookesia*, formerly *Rhampholeon*). These reptiles upset many of our notions of what a chameleon should look like. To begin with they average about two inches in total length, though one kind may attain four inches. They never turn green, but are somberly garbed in brown and black. One (*Brookesia kerstenii kerstenii*) that I found at the foot of the Usambaras was holding on to a flake of bark, with its side pressed closely against the tree trunk. Every peculiar angle of the tiny reptile's head and body seemed to suggest that this was just another sliver of bark, and its coloring contributed to the illusion, causing the little lizard to merge into the background.

But the real role of the dwarf chameleon is to resemble a dead leaf, much as their larger relatives simulate a living one. To this end their nonprehensile tails are short and look like the stalk of a leaf. A three-quarters of an inch tail is quite long for the male of one species (*B. brevicaudata*), and as that of the female is relatively shorter, one is able to distinguish between the sexes.

I once found two female *lwivi*, as the Kami call them, beneath large stones on the banks of a stream skirting the forest-edge, a curious situation for a chameleon. One of them may well have retired to the spot to lay the half-dozen eggs she held. But this was not the reason for the younger one being there. Perhaps it had gone there in search of a cool place in which to await the breaking of the rains, for at the time—October 30th—the weather was very hot.

Only a few days before, in the course of one of our marches in the mountains, Salimu picked up the smallest *lwivi* I had ever seen. It walked comfortably into the half-inch opening of Ramazan's flute. Salimu confined it there by plugging the aperture with some wool. After handing the flute to the leading porter, Salimu and I pushed on ahead to select a camping place. Ramazan, knowing nothing of the chameleon, removed the plug and played lustily on the flute as he brought up the tail end of the safari. The loss to science was only learned when he marched tootling into camp!

BIRD PETS *in* NORTH CHINA

By MABEL IRENE HUGGINS AND GEORGE D. WILDER

Photo by Mabel I. Huggins

➤ AN AIRING for the Chinese pet bird is as essential as a walk for the American dog

A visit to the market in Peking is an education in the bird life of a land where feathered songsters and acrobats are more cherished as pets than anywhere else in the world

⮟ OWNERS take their pet birds, on sticks or in cages, when they go on shopping excursions, and it attracts no more attention than having a pet dog on a leash in an American city

Photo by Mabel I. Huggins

DO YOU have a "golden wing" or a "mistletoe bird" or a "pewter beak" or an "elegant whiskers bird" or "a stupid old woman"? Probably not—but you might have if you lived in northeastern China where these are but a few of the bird pets.

Birds are more generally loved in China than anywhere else in the world. For many centuries it has been the custom to keep pet birds, but exactly when the first cages were made and when the first birds were kept in captivity we do not know. If a record that appears in one of the Chinese encyclopedias is true, the practice was already in vogue in the time of Mencius (373-288 B.C., when the Duke of Ch'i is said to have sent Ch'un-yü K'un with a caged osprey as a present to the King of Ch'u. Alas! as K'un was starting on his journey, having only left the gate of his own city, the bird escaped and flew away,—but the emissary went right on and presented the empty cage to the King of Ch'u.

Today Chinese soldiers keep pet quails for quail-fights, a custom that has been preceded by many centuries of quail-caging. From the second century B.C. comes the statement, "If you try to put the Phoenix into a quail's cage, the cage will not hold it, even if the Phoenix closes its wings."

In the third century Fu Hsien (A.D. 239-294) wrote a poem about

Photo by Mabel I. Huggins

▲ A PROSPECTIVE PET OWNER studies the birds for sale on a pushcart in a Peking market

a turtle dove. In the preface to the poem he said, "I planted a catalpa near my dwelling, and before long it developed into a grove. In leisure time, I sometimes strolled there and beheld a turtledove which sang delightfully. I caught it and fed it until it became tame. When by chance it left the cage and seemed irrecoverably lost, it would invariably fly back, hovering in the air as though it were unwilling to part from us. Hence I write this prose poem."

In the same period another poet, Tso Ssŭ, wrote:

> Flap, flap, the captive bird in the
>   cage
> Beating its wings against the four
>   corners.[1]

And in the next century the famous T'ao Ch'ien recognized that:

> The caged bird longs for the flut-
>   tering of high leaves.[2]

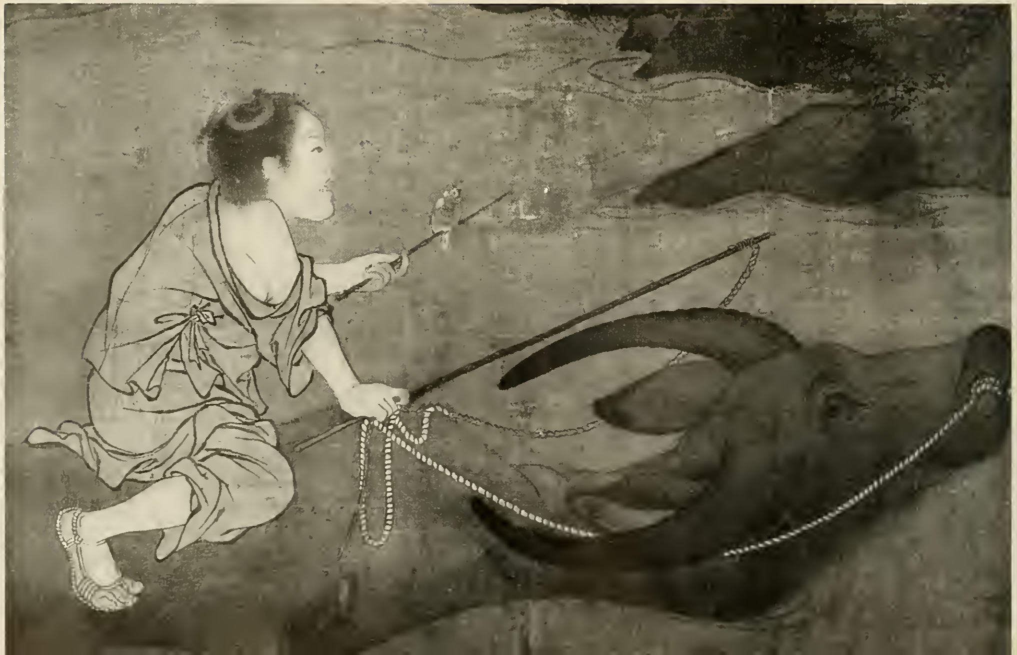
Four hundred years later Po Chü-i (A.D. 772-846), upon losing a slave girl, compared her to a caged bird that feels no debt of loyalty to its master. This same poet left some lines from which we learn that the people of his day taught birds to talk:

> Sent as a present from Annam—
> A red cockatoo.
> Colored like the peach-tree blossom,
> Speaking with the speech of men.
> And they did to it what is always
>   done
> To the learned and eloquent.
> They took a cage with stout bars
> And shut it up inside.[3]

We do not have to depend entirely upon writers for our knowledge of the keeping of pet birds in China. Painters, also, have had a share in leaving information on this subject. Take, for example, the delightful handscroll "Spring Morning in the Palace," which is one of the treasured possessions of the University Museum at the University of Pennsylvania. In one portion of the painting are three Sung-dynasty Palace Ladies accompanied by three children. Of particular interest is the little girl who is being carried in the sedan-chair, for in her right hand she holds her pet

▼ BIRDS have been prized as pets for centuries in China, as shown by this Ming dynasty painting of a herdboy fording a stream on a water buffalo with his bird on a stick. 14th or 15th century

Courtesy, Freer Gallery of Art, Washington, D. C.



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[1] Reprinted from *Translations from the Chinese*, by Arthur Waley, by permission of and special arrangement with Alfred A. Knopf, Inc.

[2] Reprinted from *Once More Fields and Gardens*, by Amy Lowell and Florence Ayscough, by permission of their publishers, the Houghton Mifflin Company.

[3] Reprinted from *Translations from the Chinese*, by Arthur Waley, by permission of and special arrangement with Alfred A. Knopf, Inc.

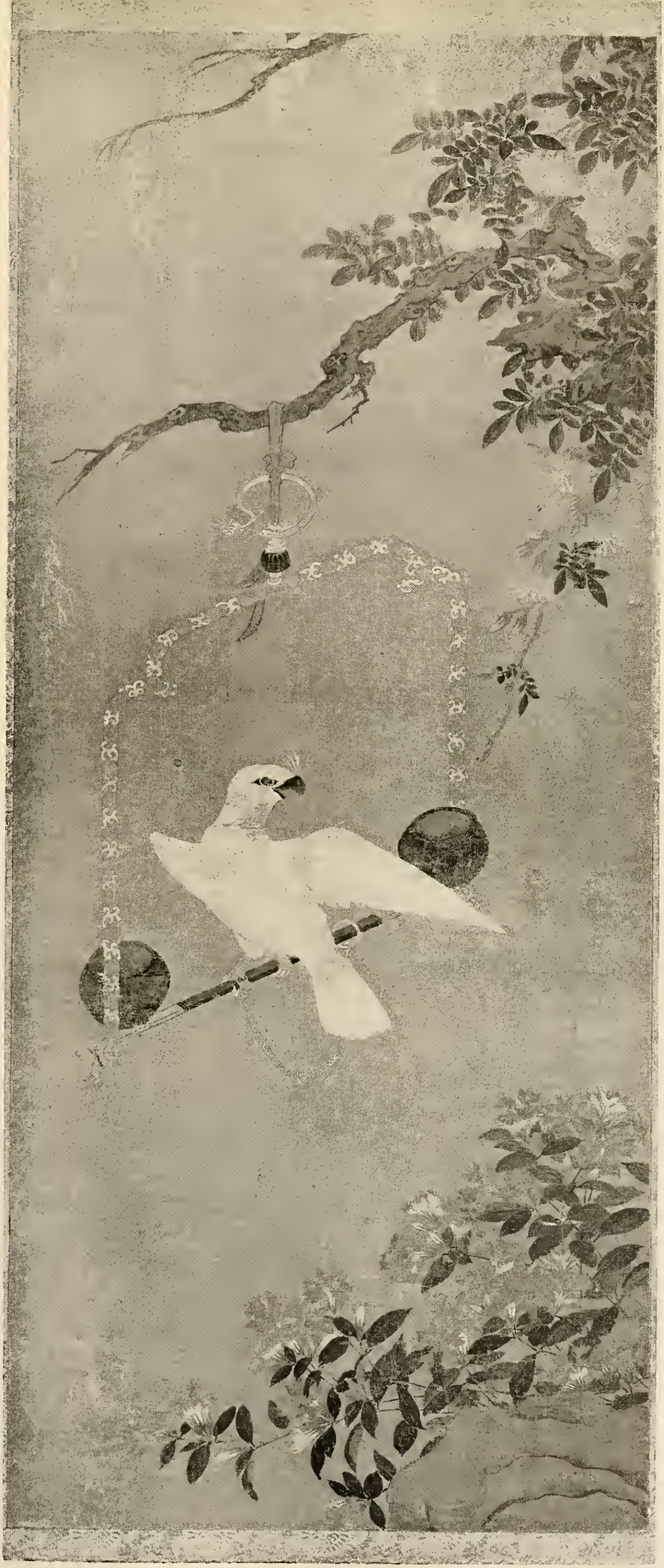
bird. Of equal interest is the woman at the extreme right upon whose arm we see two parrots. Obviously these pets are extremely tame, for there is no indication of tethering nor is there a cage in sight. In fact, they appear as well-cared-for as their owners, and almost as free.

In a later era, the Ming dynasty (A.D 1368-1644), singing birds were still popular with the imperial household. Large numbers of imprisoned songsters must have been kept, for in the western part of the Imperial City in Peking was a special building for housing them. It was known as the Hall of a Hundred Birds, a name which implied that nearly all existing varieties were in this aviary.

During the Ch'ien Lung reign (A.D. 1736-1795), craftsmen spared no pains in the making of cages that were really works of art. Lacquered wood or bamboo, ebony, tortoise shell, and ivory were utilized for the luxurious cages that were demanded by families of wealth and high station. In the production of the numerous cage accessories, the ivory carver exercised his utmost skill and artistic ability. Exquisite bits of porcelain were also made on purpose to serve as waterpots or as small flower holders to be placed on the outside of the cages. Hanging cages were given an additional touch of beauty by the finely wrought metal hooks from which they were suspended.

Even today there are Chinese crafsmen who, because they carry on the traditions and ideals of those earlier days, are justly famous for the fine workmanship that they put into bamboo cages.

But there are no cages, no matter how elegant, that can merit as much attention as is due the twentieth-century bird pets of China. These birds are carried out to take the air while their owners stroll



ARGE BIRD such as a cockatoo, parrot, vul-
eagle, or goose might be tethered by one
but a small bird was usually tethered by a
d loosely placed around its neck. Food and
dishes were placed at the ends of this
cockatoo's swinging perch, depicted in a
ing of Ming-Ch'ing period

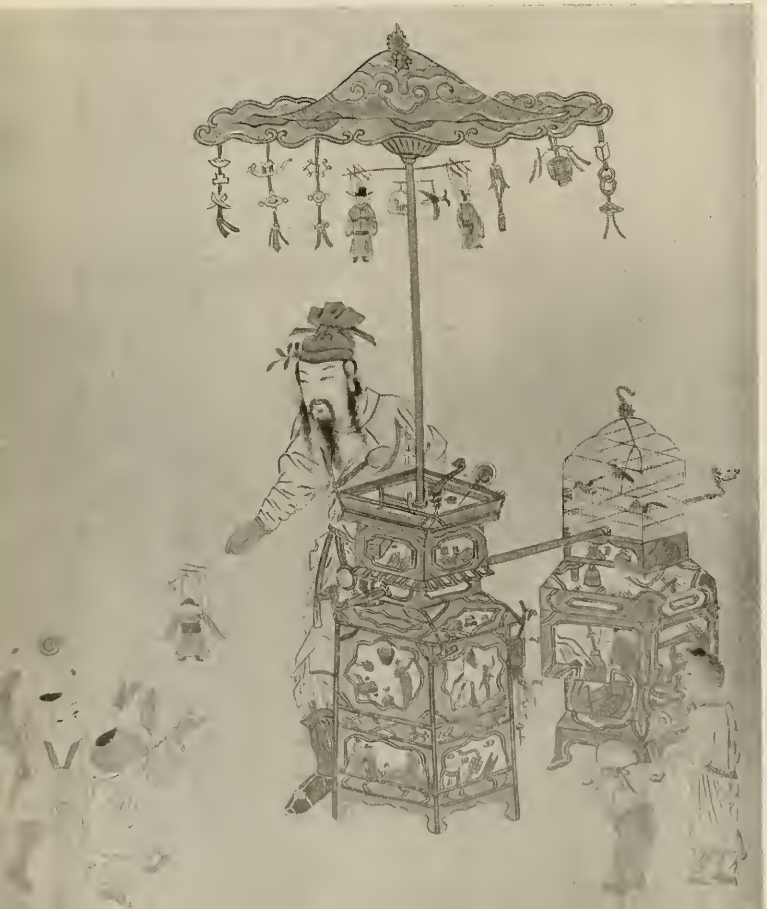
Courtesy, Freer Gallery of Art, Washington, D. C.

Courtesy, Walker Art Center

▲ A CROUCHING BOY holding a bird here forms the design for a pillow, carved by an eighteenth century craftsman in greenish-white jade

▼ THIS TOY-PEDDLER also carries with him pet birds. An album painting of the Ch'ing dynasty

Courtesy, Freer Gallery of Art, Washington, D. C.



along the sunny southern exposures of city walls or loiter in protected nooks. Many of these birds are not caged, but are tethered with strings around their necks and are perched upon sticks. Such birds are so tame that they remain undisturbed even when their masters carry them through the bustle of busy streets or into the hurry and jostle of crowded markets.

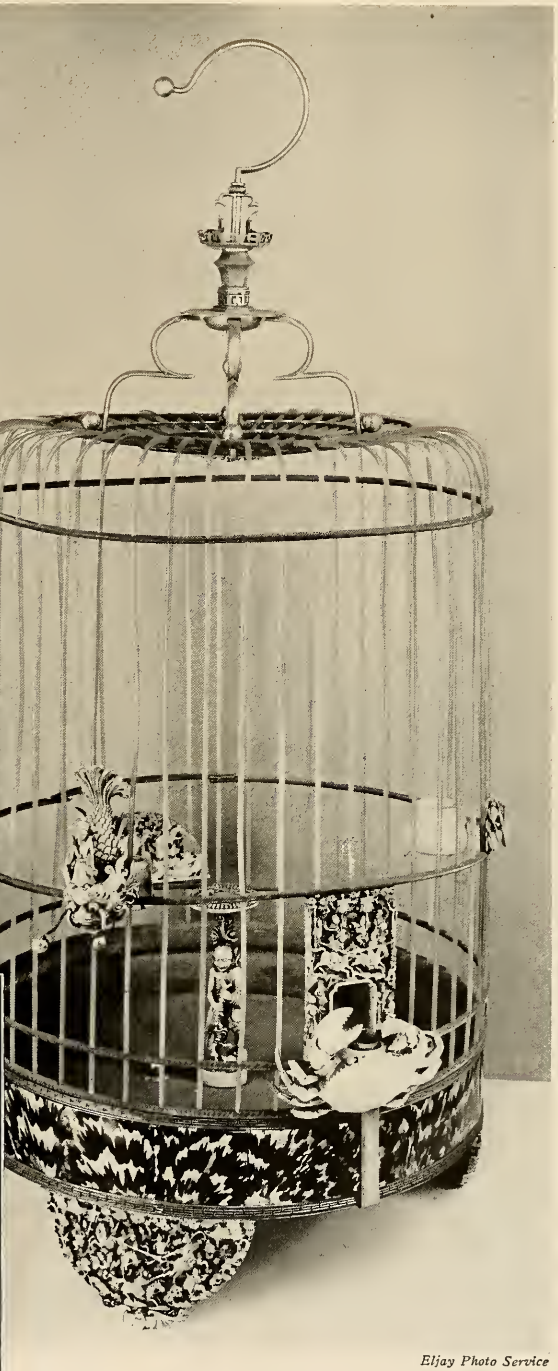
Chinese birds are valued for a variety of qualifications, one of the chief being their singing ability. Especially prized is the Ruby-throat, its name being descriptive of its most noticeable feature. On its throat is a rich flame-red spot, which is framed by a fine, clean-cut line of black in the mature bird. As a foil for this mark of outstanding beauty it has olive-brown upper parts, with breast and sides of gray and light brown. Its scientific name, *Calliope calliope* Pallas, is a complimentary allusion to the sweet-voiced Greek muse, and is in no way empty flattery, because the Ruby-throat's low warble is unusually musical. In evening and morning, and even during the night, it sings in a truly nightingale manner. The Ruby-throat is one of the birds that may frequently be seen perched upon a stick in the hands of its owner.

A better songster is the Mongolian Lark, *Melanocorypha mongolica* Pallas, which is seen everywhere in cages. When it has its freedom, it sings as it soars, its song being long-drawn-out and beautiful. In a cage it becomes a captive opera star, standing on its platform and fluttering its wings while it performs its repertoire, which includes the imitation of other birds as well as cats. It is superior as a cage-bird because it is friendly, full of fun, and willing to bring the songs of the high Mongol prairies down into the noise and dust of the cities on the plain. It is said that the Chinese are the only people for whom soaring larks sing in captivity. This has been accomplished through the invention of a circular platform of exactly the right size, which enables the bird to flutter its wings without striking either the platform or the bottom of the cage.

Another good singer is David's Babbler, *Pterorhinus davidi davidi* Swinhoe, an attractive all-brown bird, which makes a captivating pet. With a puffing out of its feathers and a rhythmical moving of its head from side to side, it gives out a pleasantly sweet song.

Although its song is more gentle and infrequent than those just mentioned, the Siskin, *Spinus spinus* Linné, ranks high in popularity. This little bird is carried around in a cage about as often as on a stick.

If measured by numbers caught and kept, the Siskin's popularity is rivaled by that of the Eastern Great Reed Warbler, *Acrocephalus arundinaceus orientalis* Temminck and Schlegel, often called the "reed winder." This bird has a habit of bringing a few reed stalks together and winding grass around them to form a crotch for its nest. When the reeds are high enough to give green cover, the Great Reed Warbler proceeds to raise two or three broods. Shortly after the arrival of the "reed winders" the farm boys



Eljay Photo Service

THE CRAFTSMAN who fashioned this lark- ge used water-buffalo horn for the "wires" ıd tortoise shell for the wide ornamental ınd around the base. The intricately carved ıod and water container and the feet of the ge show the ivory worker's skill. An ex- nple from the Ch'ien Lung period (A.D. '36-1795), in the collection of the Cooper nion Museum for the Arts of Decoration

urtesy, Minneapolis Institute of Arts

◀ THIS LIFELIKE QUAIL was carved from white jade during the Ch'ien Lung period (A.D. 1736-1795) and professional bird men begin to trap them. If one is willing to wade, it is easy to find the nests and snare the older birds. Therefore, this plain brown bird, which is quickly tamed, is about the cheapest and most common bird pet in the streets of Peking. The harshness of its loud and persistent song is rasping to the ear in the streets, but out in the open it is toned down by the vastness of the reed beds and the vault of heaven. Its song is often blended with the famous "reap-your-wheat-and-plant-your-rice" cries of the mating Indian Cuckoos, *Cuculus micropterus micropterus* Gould, as they search for the Warblers' nests in which to deposit an egg. There are two other species of Reed Warbler, smaller editions, which have much more mellow voices than the Great Reed Warbler; and as pets they are nearly as common.

The Thick-billed Warbler, *Phragmaticola aëdon* Pallas, the "tree winder," is also frequently caught and tamed. Its beautiful song is phrased like that of our Wood Thrush.

In China, just as elsewhere, markings of a striking nature and beautiful colorings are undoubtedly a factor in making birds desirable. Beside the Ruby-throat and the Siskin, which qualify because of beauty as well as song, there is the pretty little Chinese Greenfinch, *Chloris sinica sinica* Linné, appropriately named "golden wing."

Two of the buntings that are particularly liked as pets are the Yellow-throated (*Emberiza elegans sibirica* Sushkin) and the Yellow-browed (*Emberiza chrysophrys* Pallas). The former is distinguished by a broad black band below its yellow throat. A white eyebrow on its black head and a small black and yellow crest, raised when startled, are other noticeable features. The Yellow-browed Bunting has what its name implies, a broad yellow eyebrow-stripe clearly outlined against its cheeks and crown of black.

The rare Japanese Waxwing (*Bombycilla japonica* Siebold), known as the "mistletoe bird" because of its fondness for mistletoe berries, and the common Eastern Waxwing (*Bombycilla garrulus centralasiae* Poljakow) have silky plumage in exquisite tones of fawn, cinnamon, and brown with black velvet markings, and tailtips of brilliant yellow. This latter Waxwing, or "peace bird" makes not only a handsome pet but a clever one as well. With training, it becomes adept at catching pellets of food or beads thrown up for it. The quiet ways of this bird make it naturally suited to the perching stick, and that is where it is seen most often.

The Eastern Bearded Tit (*Panurus biarmicus russicus* Brehm), prized partly for its rarity, deserves mention because of its unsurpassed charm of manners in the cage. The well-groomed beauty of its soft silky feathers in blended shades of brown, pink, and buff, vies with that of the Waxwing. The jet-black, pointed side-whiskers of the male account for his Chinese name, "elegant whiskers bird."

Equally descriptive, though of manners rather than markings, is "stupid old woman," the name of the Oriental Bullfinch (*Pyrrhula pyrrhula griseiventris* Lafresnaye). This friendly, contented, rather stolid finch makes a decorative, though rare, pet. Its gray body, with underparts washed in rose-red, is set off by the glossy black of its face, crown, wings, and tail.

The ability to learn tricks is of considerable consequence in the roster of pet-bird qualifications. The Eastern Waxwing is not the only bird that is talented in this way. Perhaps the best-loved trickster is the Far Eastern Hawk-finch (*Coccothraustes coccothraustes japonicus* Temminck and Schlegel), called "pewter beak" on account of its huge gray bill. And the Lesser Black-tailed Grosbeak (*Eophona migratoria migratoria* Hartert), in spite of a clumsy English name, is nimble at tricks. To the Chinese, this common grosbeak is the "wax bill." Another "wax bill," but much more rare, is the Chinese Masked Grosbeak, *Eophona personata magnirostris* Hartert. The male, brigand-like, wears a "mask" of black, extending over his crown and around his chin. His sleek, ashy-gray body, like that of the common grosbeak, is further enhanced by shiny black wings and tail quills. Thus both of these grosbeaks would be entitled to places as bird pets if judged by their attractive appearance alone, but in addition they are skillful at tricks.

Chinese boys take great delight in teaching hawfinches and grosbeaks to catch and retrieve glass beads thrown high into the air. Flag-carrying is another of their accomplishments. These placid birds become so tame that they are often allowed to go entirely free and to fly onto housetops or into trees, and are readily summoned back to their owners' hands by some familiar call or whistle.

One of the most beautiful of the flag- and bead-performers is the Mealy Redpoll (*Acanthis linaria linaria* Linné),which has a crown of shining ruby-red and a throat and breast washed with pink. This little bird is naturally restless, lively, and not the least bit shy. The Brambling (*Fringilla montifringilla* Linné) is another small bird that easily learns to fetch and carry.

In a class by itself is the tiny Chinese Penduline Titmouse (*Remiza pendulina consobrina* Swinhoe) which, whether captive or free, goes through not only an amazing variety of unrehearsed acrobatic feats but also a series of repeated gymnastic exercises. These, when done in a cage, make it a most amusing pet. A near relative is the North China Tit (*Parus major artatus* Thayer and Bangs), which the Chinese call the *tzu tzu hei'r.* "That's what it says," remarked a Chinese friend of mine. Its bright, cheery call is one of the most common ones to be heard in the trees of Peking. This popular pet is seen in cages and on sticks in numbers almost equaling the Reed Warblers.

Another bird, prized for its individuality, is the North China Crowtit (*Suthora webbiana fulvicauda* Campbell), which the Chinese have

Continued on page 145

The Potato Chip Tree

By Jewell Casey

THE pretty little tree or shrub known scientifically as *Ptelea trifoliata* has many peculiarities and many names.

In some regions it is known as the Rattlesnake Tree, because of the rattling noise of the dried paper-like seed coverings when stirred by a fall breeze, and some give it the epithet of Skunk Bush, or Polecat Tree, because of the unpleasant odor of its crushed leaves. But perhaps the common name of Potato Chip Tree is most appropriate, inasmuch as the ripe seeds look very similar to bits of potato chips.

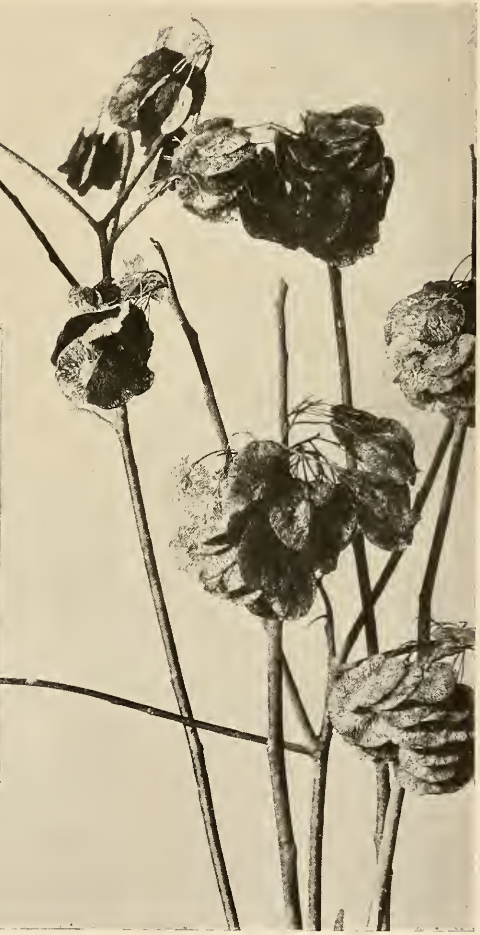
It reminded the early French colonists of hops, and they found that the leaves and seeds, when properly cured, could be used very satisfactorily in making yeast for bread and beer, so to them it was known as Hop Tree. They used the tree in other ways, as well, making the bark of the roots into tonics and using the hard, heavy, close-grained wood for many purposes.

Some people think it resembles the ash and call it Dwarf or Wafer Ash, and youngsters call it Pistol Cap Tree, pretending that the seeds are "caps" for toy guns.

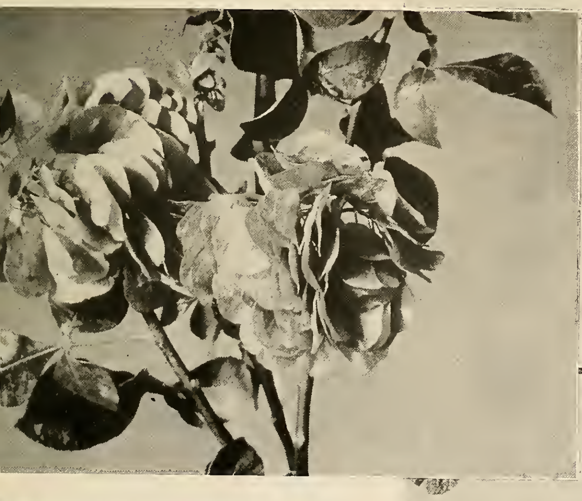
Regardless of which name is used, it is an interesting plant. It is not infrequently seen in the southwestern part of the United States, where it grows as a small tree or shrub either in sunny or shady locations, along creek bottoms and upon dry hills. However, it will grow more rapidly and become much larger if given some shade, plenty of water, and good drainage. It is said to do well under cultivation in areas as far north as New England, and it can be had from nurseries from Massachusetts and California. Because of its quick growth, it is considered desirable for screening purposes. If properly pruned and permitted to grow, it will reach a height of more than 20 feet and will make a very lovely shade tree.

In early spring the potato chip tree produces small greenish-yellow, spicy-scented flowers, in clusters of from 25 to 100, at the extreme tips of the limbs. The fruits, which contain a single seed each, are flat, paper-thin, and circular-winged. When dry they rustle pleasingly in the wind. After all leaves are gone in the fall the "potato chips" are more noticeable, remaining upon the plant until late winter.

The potato chip tree may be started by planting the seed, but the quickest way is to transplant the young plants, which may be moved successfully from the woods, or obtained from a nursery.



▸ **One look tells why this tree has been nicknamed. Its ripened seeds, after having been thoroughly "cooked" by the summer's sun, closely resemble golden brown potato chips**



▲ When seen in spring or early summer, he fruit of the Potato Chip Tree, forming ompact clusters of thin, flat, circular, deli-ate green wafers, are suggestive of the etals of some exotic flower

The Strange Leap of the Lesser Bustard

Introducing the Florican, an odd bird, which is becoming extinct because of his eccentric habits

By Dillon Ripley

ONE of the most striking birds of India is the Florican, or Lesser Indian Bustard. It is called Lesser because there are two other species of bustard in the country, as well as the Great Indian Bustard, a huge creature as big as a domestic turkey. The Florican is a daintily marked and graceful bird about the size of a Leghorn fowl, with black head and body and buffy-colored wings, finely mottled and speckled with white and black. From behind the ears of the male bird spring two tufts of narrow ribbon-like black feathers, making a most distinctive crest.

On any morning in the late summer or fall in western India a walk in the barley or millet fields will repay you with a sight of these birds. Each male has his own territory, usually in the middle of a ten-acre field. Here from morning to night he performs his dance, hardly stopping to eat and drink. The display is very curious. At varying intervals, sometimes three minutes, sometimes longer, the Florican leaps into the air. At the apex of his spring, seemingly about five feet in the air, he beats vigorously with his wings, holding himself steady. The wings clap together rather like a pigeon's on the take-off. Suddenly, as he still holds himself in the air, the Florican throws his head back onto his back and utters a loud hoarse rattle of about five notes. This is the summit of his effort, and he then sinks back to the ground, only to repeat the process a few minutes later.

What is the use of all this? It seems like such a strange and rather pointless display. The simplest explanation is that since the males stay rather strictly in their own territory while the females wander, they have to perform in some such way so that the females will know where they are. Apparently the best they can do is to jump and show themselves above the long grass.

While I was in India recently I had a chance to visit Prince Dharmakumarsinhji of Bhavnagar, the brother of the Maharajah of that western Indian state. It was September, and the Floricans were in full swing. The Prince is a very keen aviculturist, falconer, and amateur ornithologist; and one of his particular interests is the Florican, which is now getting to be a rare bird owing to its habits of self-advertisement. One of the mysteries of the Florican is its curious habit of short local migration. The migration is very irregular, not seasonal, and may skip several years. The Prince was banding the local males in order to find out whether they would resume the same territory during the following season.

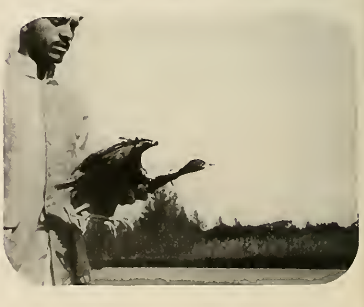
Early morning in India is the best time, because the air is cool, the light delicate, not fiercely bright, and there is a fresh dewy feeling

▲ "In a small worn place among the millet shoots we found the dancing ground of the Florican or Lesser Indian Bustard (*Sypheotides indica*), and proceeded to set up our dummy male as a lure"

▼ Close-up of the dummy mounted male bird with the horsehair snares being laid

▲ The bird is trapped. Prince Dharmakumarsinhji holds the rightful owner of the territory who has rushed up to drive his rival away and been snared in the process

▼ The Florican rests quite peacefully in the hands of the groom



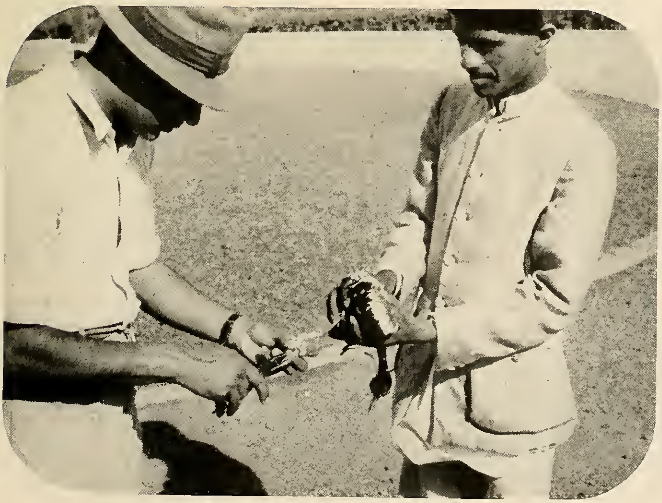
about everything. We drove out into the fields of young millet before the sun was really up. Painted spur fowl—small colorful partridges—were singing from the top of every haystack. Peacocks dodged away from the car, and a jackal ran behind a hedge.

We finally found a Florican. It was easy enough. Standing in the center of a group of several fields, you simply wait until one of them jumps up. The rattling noise carries for several hundred yards. We walked up to the spot and easily found a small worn place among the young millet shoots. The Prince's groom had brought a stuffed male Florican, mounted on a pointed stick. We stuck this into the earth. Then rapidly and with great dexterity the groom encircled the mounted bird with a series of horsehair nooses. Thereupon we retired to watch developments from behind a haystack on a slight rise in the land.

We did not have to wait long. The owner of the territory had retreated into a neighboring field, where he had made a couple of desultory jumps. I had the feeling that he was just doing it to keep an eye on us. At first we saw nothing, but soon the bird gave a jump from the edge of his own field, and we knew he was moving back. Another jump and he was much nearer. He had not actually flown at all since we had first flushed him, contenting himself with running through the grass like a pheasant. Another few minutes and we saw him, head high, standing peering about, perhaps 50 yards from the dummy bird. Suddenly he seemed to see it, for he came gliding rather like a snake with head held low, outstretched before him. The next thing we saw, the outraged owner had set upon the mounted male and was proceeding to peck at its head as hard and as fast as he could. This lasted about a minute; then he appeared to get into difficulties. The snares had caught him. In no time the fight was out of him and he was rearing back trying to get away. We ran up, caught him, and untied the snares. The bird lay quite calmly in the groom's hand while Prince Dharmakumarsinhji fastened a bronze band about its leg with a pair of pliers. Then he gave it a toss and it sailed off into the next field.

We picked up our battered dummy and went off after more Floricans. In the course of a few days the Prince had banded more than 20 of these birds, the population of a good many square miles around Bhavnagar, the capital of the State. In a year or two we may have a partial answer about the movements of the mysterious Florican.

▼ A BRONZE BAND is placed on the Florican's leg in order to record his future movements



BIRD PETS OF NORTH CHINA

Continued from page 142

named the "love-bird" for the same reason that we apply the name to the parakeet. It is charming for its saucy, gnomish appearance and for its gentle, loving ways. Its sharp, mouselike eyes and heavy hooked beak give it a quaint, quizzical expression. While free, flocks of Crow-tits frequent the brush-covered hills or dry, winter reed-beds, where they are easily entrapped; consequently, they are often found in dealers' cages. Perched side by side, they appear to accept captivity philosophically and seem to seek mutual consolation while they snuggle closely together.

In China, birds of all kinds are unprotected by the laws of the land, so great numbers are snared and trapped and taken to markets in big cities. Peking affords one of the best places for seeing and studying all sorts of cage-birds, especially through the autumn and winter. In regular shops are found such imported birds as canaries, parrots, Java sparrows, and parakeets, but in the markets may be seen the native, local birds or those that have been caught while migrating. Hundreds of bird-filled cages are set out, row after row, on the hard-beaten ground in the portion of the market given over to the bird-sellers. Pushcart loads of cages are also in evidence.

Of the 300 most frequently seen varieties of birds in northeastern China, 50 or more are used as pets and cage-birds, so the markets afford considerable choice to the prospective pet owner. Particularly plentiful are the various kinds of tits and buntings and rose finches—all twittery little birds which enliven the whole vicinity with their calls.

It is recognized, at least by the Buddhists, that birds should have their freedom, so, in order to lay up merit, many people buy birds to release them. The rose finch is one of the many varieties of small birds on the market for this purpose. However, this meritorious releasing of birds does not seem to decrease to any noticeable extent the ancient and still prevalent custom of keeping bird pets.

FLOWERS FROM THE WILDERNESS TO YOUR GARDEN

Continued from page 127

with purple, and there were a great many other kinds, in some cases with double or multiple sets of ray flowers, either forming circles or in compact masses."

The next we hear of the dahlia is in 1787, when de Menonville, on a trip to America to get cochineal insects, found tall dahlias growing in gardens in Mexico. Shortly afterward, seeds were sent to Madrid, to the husband of the Marchioness of Bute, an ambassador from England to the Court of Spain. And the single-flowered scarlet *Dahlia coccinea* was pictured by *Curtis' Botanical Magazine* in 1803. Cavanilles, who described the two species *Dahlia pinnata* and *Dahlia coccinea* (from which the forms with rounded heads are descended), was director of the botanical garden at Madrid. A third, the cactus dahlia, was sent to Europe from Mexico in 1863, and called *Dahlia Juarezii,* in honor of a president of Mexico. All the varieties of cactus dahlia were developed from a single root; but it was not until 1916 that the ancestral wild type was discovered—in Guatemala.

The ease with which the dahlia could be grown by amateurs from seeds or roots made it an exceedingly popular plant in Europe, and in 1836 over 3,000 double-flowered varieties were listed, with prices ranging from five to 21 shillings for a single plant—a situation that reminds one of the tulip craze in Europe in the preceding century. From 1860 on the dahlia's popularity declined, but it still remained a flower of great interest. Its ability to "throw sports" was one of the things that kept growers experimenting, for one could not predict what might come in the next generation. "From one variety within six years there were obtained: black, pink and maroon striped; pink; and white—all four of which were fixed and received new names." The "pompom" type of dahlia dates from 1808; the single-flowered bedding types have been known since about 1850.

Turning now to the last plant of our list, we find that there are about a hundred species of Iris in the world, all found in temperate regions. Through centuries of patient skill, the wild iris (*Iris Kaempferi*) of Japan has yielded numerous beautiful varieties, one of which is illustrated here. The history of these plants is obscure, for very few records have been left, but it is known that the first plants flowered in Europe in 1857. Cultivation of the Japanese iris has greatly increased in this country in recent years.

Of outstanding interest is the Louisiana iris, which suddenly appeared in a great number of colors in swamps of the Mississippi Delta. Dr. J. K. Small, of the New York Botanical Garden, in notes accompanying the beautiful illustrations of iris in *Addisonia,* mentions a day of both bad and good fortune. "On April 10, 1925, we were at the ferry landing about dawn, ready to cross Lake Pontchartrain, only to learn that the ferry engine had broken down. There we were compelled to fight mosquitoes until the ferry boat was repaired." But here Dr. Small found some of the peculiar irises, and "farther in toward New Orleans many beautiful irises came into view in the swamps. Various irises of red, white and blue were prominent and other colors were in evidence. Three distinct groups of the genus proved to be there represented, and new species with flowers of shades of color never before recorded in American irises were more numerous than imagination would ever have suggested."

Many of these irises were described by Dr. Small as distinct species. But Dr. George M. Reed, of the Brooklyn Botanic Garden, working on hybrids of the reddish-flowered *Iris fulva,* produced many of the same plants that Dr. Small had seen growing wild. (See illustration on page 124.) As R. C. Foster says (1937), "Presumably if more numerous F^2 progeny were raised and back-crosses to the original species were made, coupled with crosses between the seedlings, the riot of color forms now existing in Louisiana could be duplicated in a controlled experiment." And Viosca, in a careful study of the environment of the Louisiana iris (in *Home Gardening,* April-May, 1941) believes that there are three optimum conditions operating for the hybridization of these plants in nature: 1) very favorable contacts between the two (or perhaps three) species of iris in the regions just above tidewater; 2) cutting of drainage channels, which has caused more water than usual and increased abundance of iris; 3) in some places the presence of cattle, which have cut out competing plants.

This Louisiana iris then, is a plant of which we seem to know the true origin, and its history is recent. The hybrid, *Dorothea K. Williamson,* is already a well-known garden plant. In the years to come, with constant selection, may we not achieve forms as strikingly beautiful as in any other cultivated plants?

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Continued from page 103

while the book contains more than 700 pages, it is of pocket size and is hardly more than an inch thick. The illustrations consist of excellent line-drawings and the descriptions are simple and clear. The keys to the various groups of trees are dichotomous, that is, each step consisting of two mutually exclusive characters or combinations of characters,—the kind of keys approved by this reviewer.

Each tree is described with reference to general appearance or habit — leaves, flowers, fruit, twigs, bark, habitat, range or distribution, and importance.

The senior author is Professor of Wood Technology in Duke University, while the junior author is Director of Agriculture in Mexico, Rockefeller Foundation, formerly Professor of Biology in the Virginia Polytechnique Institute.

The making of single words of such names as pricklyash, mountainlaurel, herculesclub, and baldcypress is at variance with the dictionaries. While redcedar and whitecedar are single words, the names red spruce, black spruce, white pine, and mountain maple each consists of two words.

All in all the book is an excellent and attractive guide to the trees of the region treated.

CLYDE FISHER.

PATTERNS OF CULTURE

- - - - - - - by Ruth Benedict

Penguin Books, Inc., 25¢

WHEN *Patterns of Culture* first appeared a little over 10 years ago, it immediately became one of those books with an obvious future. It is good to see it reprinted now in a cheap edition accessible to everyone—now especially, because never have we needed more the fundamental understanding of the nature of culture and its profound effects upon our behavior and our attitudes that Dr. Benedict so cogently and so gracefully sets forth in this volume.

Culture, as Dr. Benedict explains, represents one particular choice in the range of possibilities. No culture embraces them all. This leads to a relativity in cultural values which it is imperative to accept, but it should not be permitted to warp our judgments.

Culture, moreover, is more than a catalogue of its ingredients. The way in which these elements are integrated and function confers a pattern or a configuration upon them that distinguishes one from another and also reacts upon the cultural components themselves, infusing them with a value and a tension they would not have in a mere chaotic agglomeration of traits. To illustrate these patternings Dr. Benedict describes at some length three contrasting cultures: the temperate Zuni which she calls Apollonian, the braggart and dionysiac Kwakiutl, and the suspicious and double-dealing Dobu.

Having illustrated the tendency of culture to acquire its own orientation, she then deals with its impact on the individual. And in a concluding section she suggestively discusses the nature of psychic maladjustment in terms of culture.

Books dealing with abstract concepts of culture and exploring their theoretical ramifications are rarely readable by more than a few experts. Here, however, is one that requires no more than intelligence. It's worth reading.

HARRY L. SHAPIRO.

THE BIRTH AND DEATH OF THE SUN

- - - - - - - by George Gamow

Penguin Books, Inc., 25¢
219 pages, 76 illust.

OUR sun is a star, and every star is a sun, and here is a modern book on the evolution of stars with especial reference to our sun. The author was formerly a student of Niels Bohr, and is now Professor of Theoretical Physics in George Washington University. Professor Gamow is one of the outstanding writers of science for the non-specialist. In the facility for making astronomy clear and at the same time fascinating for the layman, he easily ranks with Sir James Jeans and Harlow Shapley. The book is dedicated to one of the world's most brilliant astronomers, one of the leading students of the sun, Henry Norris Russell.

One of the most interesting parts of the book is the discusson of origin and conservation of the sun's energy. In 1938, Professor Hans Bethe of Cornell University set forth in a technical paper a new theory of the heat of the sun and other stars, for which he received the award of the New York Academy of Sciences. This theory has now been generally accepted by astronomers, and Professor Gamow is the first scientist to treat this intricate subject adequately in a popular book.

It is only since the atom has been split, only since we have found that the atom is not the fundamental particle of matter, only since Professor Einstein has shown that matter and energy are interconvertible, that scientists have been able to attack the problem with understanding. According to the Bethe theory, the origin of the sun's heat is due to the release of atomic energy or subatomic energy, as Professor Gamow calls it. The whole process may be described as "the transformation of hydrogen into helium as induced by high temperatures and aided by the catalytic action of carbon and nitrogen." To make this simple and clear, as Professor Gamow has done, was an achievement.

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Continued from page 101

cal gardens at Berlin and Munich. The existing purebred bison were not exactly an ideal nucleus for breeding, for in spite of their huge size and great strength, they were not really robust and healthy.

During the initial stages of the Society the animals suffered further setbacks through disease, so that by 1930 no more than 60 wisent remained, and more than half of them were bulls. Despite all efforts by the Society, the bison did not show any real improvement. After 20 years they had barely doubled in number, which was discouraging in view of the normal rate at which cattle breed. As a safeguard against complete extinction, American bison cows were bred with pure-blood wisent bulls. It was argued that bison-wisent were better than no wisent at all.

Whether or not all the money and effort spent to perpetuate the animal on the continent has been in vain has not yet been determined. Fortunately there are still a few zoological animals in neutral countries. The small herd that was near Visegrad in Hungary may not have been annihilated in World War II, and the chances are that the animals at Lansoe, Sweden, had a better chance to survive. The brightest prospect is the herd at Woburn Abbey, England. Before the recent war, the Duke of Bedford's herd there was the largest in existence. It included 20 pure-blood wisent and 19 cross-breeds. But like the American bison, the wisent as a wild animal has gone with the times, never to return.

* * *

Sirs:

A friend of mine had two missionaries as guests for dinner the other night. During the after-dinner discussion the woman, who has spent most of her life in Africa, told of an incident which I find difficult to believe.

She told of riding along a dirt road in a whippet touring car that was traveling full speed, between 35 and 40 miles an hour, and having a mamba racing along beside the car in an effort to get ahead of the car in order that it could strike the driver of the vehicle. This race lasted for several minutes as the occupants of the car sat frozen with fear; but finally, the car began to draw away from the snake, and he abandoned the chase.

My hobby is snakes, and I have never encountered a snake in my experiences that could not be outdistanced by a slow trot . . .

R. S. Hamilton,
Instructor of Biology,
Boulder Public Schools.
Boulder, Colorado

The following comments are offered by Mr. C. M. Bogert of the American Museum's Department of Reptiles and Amphibians:

Although a speed of 30 miles an hour has been attributed to the mamba in a popular summary of speed in animals published in England, I do not believe it for an instant. I have talked with several trained observers who are acquainted with the black mamba in the field, and whereas all of them agree that the snake is one of the swiftest, not one of them believes that the snake can exceed ten miles per hour at the most. Dr. Raymond B. Cowles, who lived for years in Natal, believes that the mamba is about as rapid in its movements as the North American red racer. A maximum speed of less than four miles an hour is all that has been ascribed to this snake in the only scientific investigation that has been made, but the author (Dr. Walter Mosauer) was willing to believe that the snake could exceed this speed somewhat if conditions were just right and the snake were frightened.

All sorts of fantastic speeds have been estimated (and sometimes published) for various animals, but few will stand up under investigation. It is exceedingly difficult to time animals accurately, and guesses concerning the speeds attained are virtually worthless in the majority of instances. Some of the snakes that appear to be capable of rapid movement are not able to pass a man walking when they are liberated in open country, even though the terrain is sufficiently rough to permit the snake to crawl efficiently. If small trees, rocks, or chaparral are present, the same snake can easily outdistance a man because of the advantage inherent in the snake's slender body.

Returning to the mamba story, there are other features that lack the ring of authenticity. The black mamba, the larger of three distinct species in Africa, is known to attack man, but there are no authenticated reports of its doing so unless it is cornered or provoked. Moreover, it is extremely doubtful that a mamba would attack a car, much less realize that a man was in it. Many animals, including lizards and snakes, can be approached in a car without being frightened; there are many indications that reptiles and mammals do not recognize a car as an animate object. The black mamba is not likely to be an exception. Finally, no reptile is capable of sustained rapid movement. Even the lizards of the open desert, possibly the fastest reptiles in existence, with speeds that may exceed 20 miles an hour, are capable of only short dashes. When liberated in the open on such terrain as that found on the bottoms of dry lakes where no burrows or crevices enable them to seek shelter, they easily leave man behind them. But with a little persistence, a man can eventually catch up with the reptile, which lacks any ready reserve of energy. All in all I would not say that there were any grounds for believing that a mamba attained a speed of 35 miles an hour and managed to continue at this rate for several minutes.

April **NATURAL HISTORY** 1946

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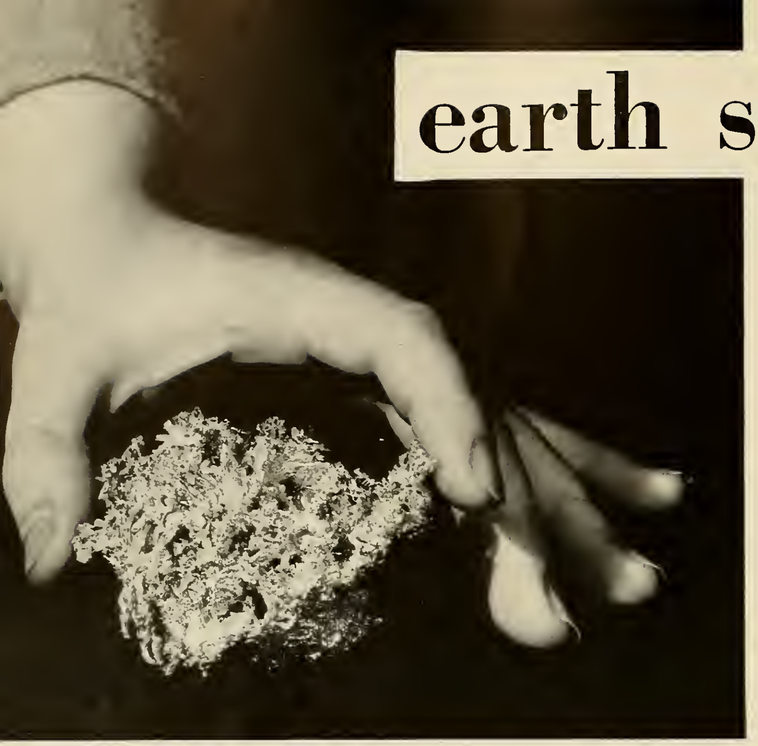

A piece of crystallized gold from Nevada County, California—*A.M.N.H. Photo*

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LETTERS

Sirs:

I was particularly interested in John Eric Hill's article (February, 1946) on the friendly White-foot Mouse, because we have seen so many of them at a log cabin which I erected about 33 years ago on the summit of Martin's Mountain, about ten miles east of Cumberland, Md. An encounter I witnessed between a three-foot black snake, or racer (*Coluber c. constrictor*), was rather interesting.

I was driving along one of our mountain roads with three of my friends when we saw the snake some distance ahead, and when we drew closer we discovered that it had grasped the mouse by its side. The snake was trying to work the mouse around so as to engulf it head-first, while the mouse was trying to get its teeth into the snake's jaw.

Finally the snake loosened his grip and attempted to grab the mouse's head, and that is where he made his one mistake. The mouse was a fraction of a second faster than the snake and fastened its teeth through the snake's lower jaw. No bulldog could have done a better job of holding on. The snake went through all kinds of contortions in the effort to shake the mouse loose, and after about five minutes succeeded. The snake then immediately shot off through the brush like a black streak.

Did the mouse run away? He did not. The little warrior, much mussed but full of fight, walked backward and forward a distance of about a foot, looking toward where the snake had gone, and every move seemed to say, "Come out and fight, you big brute."

D. P. LeFevre.

Cumberland, Md.

* * *

Sirs:

Perhaps your readers may be interested in this photograph of a tree. Some of them may have observed the same kind of ring and wondered how it may have been produced. Hundreds of other trees have the same kind of mark on them, the mark always being parallel to the ground. This particular tree is located in the "bottomland" area of the Patuxent Research Refuge, Bowie, Md. There is usually quite a guessing game when people see these rings for the first time.

The explanation is apparently that the rings are caused by flooding of the lowlands. When the water freezes and subsequently thaws, the ice adhering to the bark forces the loose bark to detach itself, thus leaving a lighter ring around the trunk.

Paul E. Illick.

Bowie, Md.

* * *

Sirs:

Have you any information on the peculiar habit exhibited by certain birds of grasping an ant in their beak and rubbing it vigorously on their feathers? Do any birds in eastern United States do this?

John A. Stewart, Jr.

Trenton, N. J.

* * *

The following comments are offered by John T. Zimmer of the American Museum's Department of Birds:

The curious behavior of birds that is called anting has been recognized only fairly recently as a definite activity of rather widespread distribution. It has been recorded in 40 or more species of birds belonging to fourteen different families, about half of which are North American, the others European and Asiatic. The probability is great that it is even more widely practiced than we have yet discovered.

Not all observers agree as to the exact procedure followed by the birds, and it is probable that it is not always uniform. The simplest behavior appears to be shown when a bird settles itself on an ant hill and allows the ants to crawl through its plumage and carry away any parasites they may encounter. This was recorded as early as 1876, but it may be doubted if it can be classed as anting in the sense now used. A simple dust bath

Continued on page 152

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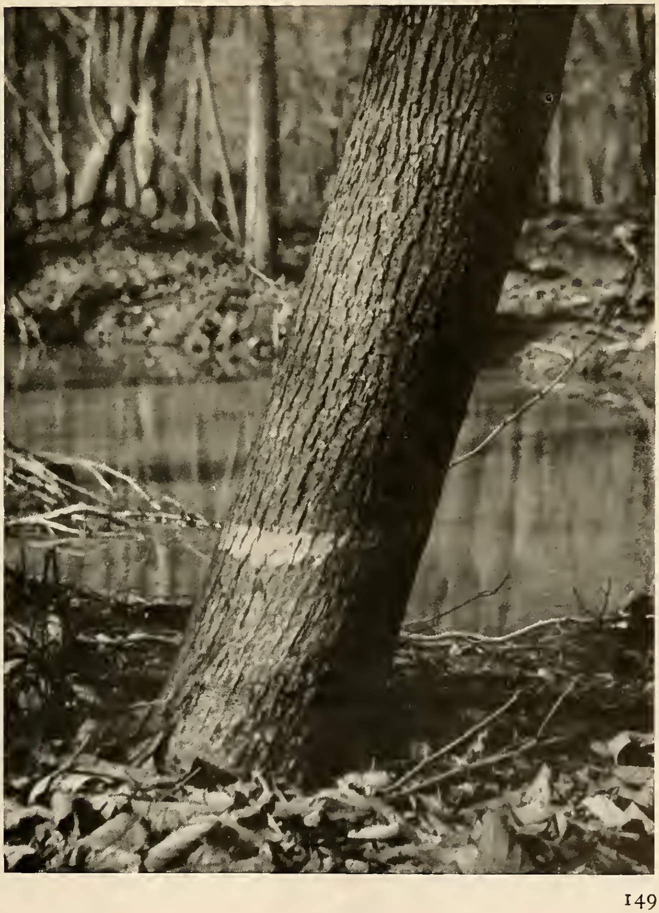

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The Magazine of the American Museum of Natural History

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VOLUME LV—No. 4
APRIL, 1946

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From a Kodachrome by Edward L. Bailey

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You will find Natural History Magazine indexed in *Readers' Guide to Periodical Literature* in your library

THE COVER THIS MONTH

The Blue Jay—bold, intelligent, and noisy—has few endearing qualities, but it holds a place in the countryside that is its own. When the winter landscape is dull and colorless, its lively activity often brings a flash of brighter blue and white to enliven the scene. Singly or in small companies, it explores the ground, the trees, and the feeding shelf to see what may be found, often making the air resound with its harsh cries.

With the arrival of spring, it becomes preoccupied for a time with family cares. Choosing a tree with heavy foliage, such as an evergreen, the pair builds its nest in a crotch not too far above ground, in which the four to six eggs are laid in April or May. The eggs, dark buff or olive green with brown spots or blotches, are incubated for 15 to 17 days. Both sexes help to build the nest and both warm the eggs and feed the young.

Besides its harsh calls, the Blue Jay has other notes, some of which are even soft and musical. It is true that it sometimes destroys the eggs and young of other birds, but on the whole its food habits are beneficial. In spite of its mischievous ways, the jay is a cheerful rascal that deserves some commendation, if for nothing else, for its willingness to stay with us when skies are gray as well as when they are as blue as its own active wings.

John T. Zimmer

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LETTERS

Continued from page 149

in an ant hill may be anting of a rudimentary sort, since the dust presumably is somewhat impregnated with formic acid—one of the factors that seems to play a definite role in the full procedure. True anting is practiced when the bird picks up ants in its bill and rubs them, either crushed or whole, on the under side of the wing and tail feathers, rarely on any other part of the plumage. The ant may afterward be eaten or not; its final disposal appears to be purely incidental.

Some curious theories have been advanced to explain the procedure. Some less accurate observers have thought that the bird merely places the ants among its feathers where they would attach themselves by their mandibles and provide a supply of food for the bird on a forthcoming journey. This explanation has little to recommend it. The most credible theory is that the formic acid of the ants has an insecticidal effect on the bird's ectoparasites, although why it should be applied almost exclusively to the wings and tail is not apparent. In this connection it may be noted that there are recorded instances of birds using other aromatic materials in the same way, including lemon and orange peel, vinegar, beer, and cigar stumps!

The action of anting sometimes appears to have a slightly stimulating or intoxicating effect on the birds, part of which may be due to the ants that are eaten but some of which may result from external irritation. No laboratory studies have yet been made, so far as I know, to discover the physiological or other bases underlying this interesting problem. A number of field observations will be found recorded in the *Auk*, volumes 55 to 62, 1938-1945.

* * *

SIRS:

After reading NATURAL HISTORY for seven months may I express my appreciation of your magazine.

I like the illustrated article entitled "The Wilderness Belongs to the People."

Here's hoping for continued success.

CARLTON CHESTER.
Norwich, Conn.

CORRECTION

The Iris known as Gayoso, described on page 123 of the March NATURAL HISTORY, is a variety of the European Bearded Iris, rather than one of the Japanese Beardless Irises.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

▲ "RECEPTIVE ATTITUDE:" springtime appetites graphically portrayed in an unusual photograph of a robin's nest taken by Ralph E. Gustafson

ON YOUR RADIO

"Dance Horizons," a new weekly radio series of the American Museum of Natural History, arranged by Hazel Lockwood Muller, will have as guest speakers and musicians many of the talented artists who appear on the Museum's free programs "Around the World with Dance and Song." These half-hour programs will be broadcast over WNYC every Monday at 4:30 P.M.

April 1—Indian Songs and Dances, with Grace and Reginald Laubin
April 8—Russian Folk Dance Music, with Radishev Group and Ukranian Chorus
April 15—"Christopher Columbus," with Edwin Strawbridge Players
April 22—Dance Music of Bali and Java, with Hadassah
April 29—Dance Rhythms of Africa and West Indies, with Pearl Primus, Norman Coker, and Alphonse Cimber

"People Make Music," a series conducted by Dr. Louise K. Myers at 6:30 P.M. every Saturday over WNYC (830 on your dial).

April 6—African Music in the New World

April 13—What Makes It Sound Oriental: Chinese Music

April 20—What Makes It Sound Oriental: Indian and Arabian Music

April 27—In the Far Islands of the Far East

●

"Science for the Seven Million" speculates on natural science in the postwar world. Julius Postal conducts this program of news about museum events, meetings and nature study on Wednesdays at 3:30 P.M. over WNYC.

YOUR NEW BOOKS

ASTRONOMY ● INSECTS ● INDIANS
ATOMIC BOMBS ● BEGONIAS ● ROCKS

CHINA-TIBET-ASSAM

- by Lt. Col. F. M. Bailey C.I.E.

(A Journey—1911)

Published by Jonathan Cape, London, 1945. Price 10 s 6 d
176 pages, 8 illust., 2 maps

IN a modest, straightforward, and somewhat chronological style, Col. Bailey gives an uncolored story of a very remarkable and most difficult journey of exploration taken some years ago through one of the most remote and untraveled sections of country left in the world. Here, in and around eastern Tibet, where many savage and superstitious tribes often look upon strangers as evil beings who are much less trouble dead than alive, he made his precarious way, surveying and mapping new country.

With a considerable background from previous experiences and exploration in and around Tibet, which he first visited as a lieutenant with the famous Younghusband Lhasa Expedition of 1904, and speaking Tibetian and Chinese fluently, he herein writes with authority and much understanding about one of his remarkable journeys of real exploration while on leave from the Indian Army during the early spring and summer of 1911.

Leaving Chungking, he headed westward with only one native servant to explore the headwaters of the Menkong, Yangtze, and Salween Rivers and to solve some of the geographical questions concerning them. He lived off the country and often traveled without tent or shelter in order to reduce the impedimenta of otherwise necessary baggage. He made his way toward the high reaches of the borderlands of Tibet and Szechwan and then generally southwestward through Assam to India.

With a very good working knowledge of zoology, he describes for us many valuable specimens that he observed and collected. He also recorded his observations of the little known flora. Particularly interesting were his experiences with the strange, cowlike mountain antelope called the takin, which he encountered in a herd of 200 animals on one occasion.

He saw many different varieties of rare and beautiful pheasants in their natural habitat. The birds were often so plentiful that he shot them for food.

Particularly interested in butterflies, he discovered and collected many new species, several of which now carry his name.

While going through uncharted country, peopled with decidedly unfriendly tribes, it was often necessary to follow along the precipitous walls of deep gorges. He made many valuable and accurate geographical records and maps of these routes.

The most important part of his journey was made in altitudes from seven to seventeen thousand feet, and one realizes that the author had remarkable fortitude in the face of dangers and the trying discomforts of the trail.

For those interested in learning something of this very little known heart of Asia and its primitive tribes, this book is most interesting reading. The fact that Colonel Bailey received for his scientific findings the Gold Medal of the Royal Geographical Society and the Livingston Gold Medal of the Royal Scottish Geographical Society shows the value of his tireless work while on this truly remarkable journey.

JAMES L. CLARK.

ATOMIC ARTILLERY AND THE ATOMIC BOMB

- - - - - - - - by J. K. Robertson

D. Van Nostrand & Company

IT was inevitable that the dramatic disclosure by the U. S. Army of the success that crowned the mystery-shrouded efforts of thousands of workers for several years, would simultaneously unleash upon the literate world a flood of popular explanations of the innermost secrets of atomic structure. This is not a wholly undesirable consequence, for few scientists have been less successful than the nuclear physicists (in their extremely modest efforts, to be sure) in explaining their work, their achievements, and their goals.

The re-issue of this book starts with a clear explanation of the known facts of physical chemistry and then goes into electrons, cathode rays, isotopes, radioactivity, photons, mesotrons, neutrons, and cosmic rays. Atomic bombardment and the explanation of how radioactivity isotopes are created lays the groundwork for the atomic bomb explanations.

The early part of the work is simple and rational. The reader will understand the nature, working, and accomplishments of cathode ray tubes, the Mass-spectrograph, and the cyclotron. Later on, the chapters on bombardment and radioactive disintegration tend to become more involved, and Professor Robertson begins to sound more like a physicist. The book is good groundwork for the reading of the Smyth report, but the latter work will remain a classic in scientific literature as a clear and logical (if slightly redundant) explanation of the events which led up to the successful attainment of the goal of the Manhattan Project. The atom bomb chapters added to this book cannot take the place of the Smyth report, but the introductory material here will lead to a better understanding of that work, which will go down in history as a science classic, the first announcement of a scientific accomplishment that must change our thinking and our international behavior if man is to survive.

F. H. POUGH.

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THE ROAD OF LIFE AND DEATH

- - - - - - - - - - by Paul Radin

Pantheon Books, Inc., $4.50
345 pages

THIS volume, which is number five of the Bollingen Series of the Old Dominion Foundation, bears the subtitle, "A Ritual Drama of the American Indians." The foreword is by Mark Van Doren. The author, a well-known ethnologist, here gives us an account of the Winnebago Indians whom he has studied since 1908. Some years ago he edited *Crashing Thunder, The Autobiography of an American Indian,* also a Winnebago study. Dr. Radin is the author of *The Indians of South America* in the American Museum of Natural History Series.

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The Road of Life and Death was the most sacred ritual of the Winnebago Indians down to the early years of the present century. When their numbers were decimated by their earlier intertribal wars and their way of life was upset by the encroachments of the white man, they gradually came to have less confidence in the efficacy of this secret Medicine Rite. Out of this unrest came a need for a new religion to take its place. The Peyote cult, introduced from the south, was soon accepted by many of the tribe.

Dr. Radin came among the Winnebago Indians in time to learn about the sacred ritual of the Medicine Rite, which reaches far back into Winnebago culture. It would probably have been impossible to secure this information at any other time. His informant was Jasper Blowsnake, an older brother of Crashing Thunder. Dr. Radin has translated the complete Medicine Rite into English in this book. The theme of the Medicine Rite is that the deity, Earthmaker, grants "the possibility of transcending death, by means of successive reincarnations," on the condition that man "agrees to face life and its vicissitudes in accordance with a specific ethical code."

Everyone interested in the religious life of the Indian, and in the history of religion will be attracted to the seeking, on the part of these primitive people, for a full and happy life on earth, and a return to it after death.

Te Ata.

ROCKHOUNDS AND ARIZONA MINERALS

- - - - - - - - - by A. L. Flagg

Whispering Winds Press, Phoenix, Arizona
$2.00. 82 pages, 2 color illustrations

THE growth of the hobby of mineral and rock collecting to its present proportions has been marked by the appearance of several popular books that try to help the tyro in the identification of his finds. Very few of these have revealed in the way this book does the spirit of the enthusiast, the lover of minerals who wishes to impart his enthusiasm as well as his knowledge to those less experienced.

A. L. Flagg has been a miner and a mineral collector for many years, and he shows his appreciation of the beauty of minerals and of the outdoors in the text of this small book. He points out that minerals should be properly labeled, carefully handled, unselfishly displayed, and generously bestowed on others; that mineral collecting can be a hobby which will enlarge one's whole life. It leads to education in many subjects, for geology is the broadest of all sciences, including chemistry, physics, biology, astronomy, geography, and mathematics, the specialized branches of which provide lifetimes of work for scientists. The smattering of knowledge of the different fields gained through the intelligent pursuit of this hobby makes it the richest of all in fundamental scientific training. Nor is there any limit, beyond the mental capacity and inclination of the hobbyist, to his investigations in any specialized branch that he may select.

This little book, with its guides to collecting, its instructions on where to go, and its suggestions of what to look for, has an appeal extending far beyond the boundaries of the state of Arizona, for minerals, like good collecting manners and good collectors, are universal.

The two color plates, the sketches at the chapter heads, and the make-up of the book make it by far the most pleasing mineral book of recent times. The author and the publisher are to be commended; one can only wish it were three times as big and three times as useful.

F. H. Pough.

ASTRONOMY

- - - - - by Russell, Dugan and Stewart

Ginn and Company, $3.00
Vol. I, Revised Edition
470 pages, 183 figures

THE revision of our leading advanced textbook of Astronomy will be welcomed by everyone interested in the subject,—especially by students and teachers. After 19 years, Volume I, on the solar system, has been brought up to date, by Professors Russell and Stewart. Almost the whole of the original contribution of Professor Dugan, who died in 1940, has been retained, and he is still equally to be regarded as an author of the book.

The changes and developments in our knowledge of the solar system, as recorded in the literature from 1926 to 1945, have been carefully incorporated in the new text. As stated in the preface, practically all of this work has been done by Professor Russell, who is universally regarded as one of the most brilliant astronomers of the world. Not all of our great scientists have taken time to prepare textbooks. Students of astronomy are especially fortunate that they have a textbook in which every statement has been checked by a great astronomer of well-balanced judgment.

Since 1926, Pluto, a new planet, has been discovered, and two new moons of Jupiter. Carbon dioxide has been discovered in the atmosphere of Venus, and ammonia and methane in the atmospheres of the four large outer planets. The distance to the Sun has been more accurately determined by H. Spencer Jones, Astronomer Royal, and this has changed appreciably the yardstick, the astronomical unit.

In the last paragraph of the book, we find the statement that the history of our solar system is still very obscure.

Astronomers will now look forward to a thorough revision of Volume II, Astrophysics and Stellar Astronomy, which was partially revised in 1938.

Clyde Fisher.

INSECT DIETARY

- - - - - - - by Charles T. Brues

Harvard University Press, $5.00
466 pages, 22 plates, 68 figures

THE previously unsynthesized and widespread literature dealing with the food habits and dietary characteristics of insects is presented here in a lucid and stimulating manner that has both popular and technical appeal.

Professional biologists will find this book especially valuable for the lists of relevant publications given at the end of each chapter, and many a biologist will be stimulated into making inquiries into this subject and will find the assembled knowledge of great value in

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studies of systematics, genetics, physiology, morphology, phylogeny, and many other fields. This well-organized book is the first standard reference in this subject.

The reader is confronted at once by the abundance of insects in comparison with other organisms, and the fact that aside from the microscopic Protozoa the only other animals that in any way approach insects in numbers of individuals are the earthworms and the marine crustaceans representing the group Copepoda. The number of living species of insects that have thus far been described by entomologists far exceeds that of all other living animals. It is estimated that 520,000 species have been described and that the total number of living insects probably reaches the almost unbelievable figure of 10,000,000 species.

The great diversity of food habits and the utilization of unusual materials for food by insects is discussed in detail. Such materials as horn, beeswax, cork, pepper, cured tobacco, and other materials are the exclusive choice of certain species. The amount of food consumed by insects, especially vegetarian ones, is enormous and is the reason for their great economic importance to agriculture. It is estimated that 10 adult grasshoppers per square metre in a one-acre field would destroy 607 pounds of grass during their development.

The importance of certain insects to the food supply of man, either directly or indirectly as food for our various food animals, especially fishes and birds, is presented to show that not all insects are injurious to man. The diversified problems involved in the wholesale application of the insecticide DDT in our insect control programs are presented.

The work is illustrated with a number of fine photographs and drawings that add considerably to the text.

Mont A. Cazier.

Begonias and how to grow them

- - - by Bessie Raymond Buxton

Oxford University Press, $2.25
163 pages, 39 illustrations

THE general impression after reading this book is a mingling of satisfaction and despair. The satisfaction is derived from a good book written by a competent author enthralled by her subject. One is impressed by Mrs. Buxton's painstaking disinterment of the history of the many species of begonias and of the production of hybrids. The despair concerns the confusion in the nomenclature of many of the species.

An amateur gardner feels ill at ease discussing such a relatively specialized work. He almost wishes that he were a devotee of begonia culture so that he might fully appreciate Mrs. Buxton's work. This amateur applied to the book a simple, if not quite fair test—unfair because the work is written chiefly to aid persons in growing the plants. He tried to identify the eleven sorts of begonias growing in the windows of his home. He met success with five varieties; the others await further study.

It is uncertain whether modern geneticists will recognize those aberrant leaves that at times appear among the normal leaves of hybrid plants (page 8) as reversions to original wild types; such phenomena are susceptible of different explanations—including new chromosomal combinations, polyploidy, etc. And did *B. nepalensis* really come from Africa

Continued on page 196

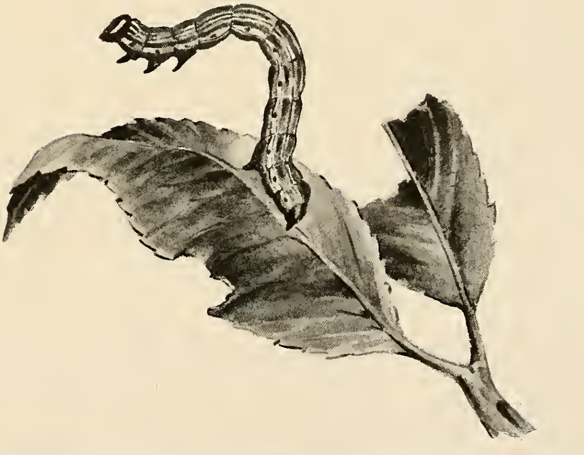
Insects in the House

"MEASURING WORMS"

By C. H. Curran

ALTHOUGH they are not commonly associated with life indoors, the caterpillars of several geometrid moths sometimes are sufficiently numerous in spring and summer to become household pests. They may be blown from trees and will then roam in search of a fresh supply of food. But more often they are objectionable because they drop from trees by means of a silken thread and land on people.

They are commonly known as inchworms, measuring worms, or cankerworms. When very numerous they may completely defoliate trees during spring and early summer. They were moderately bad in 1945, but if they follow the usual pattern, they will be extremely numerous in the New York area this year. Next year they will be practically absent, although some pockets of resistance may remain. Their disappearance in 1947 will be due to the fact that their parasites will have caught up with them and because there will be high mortality from starvation caused by an insufficient food supply. In the meantime, the use of poison sprays will help to control them.



By William H. Carr

All photographs by U. S. Forest Service

THE United States Forest Service people have a word for it; so have cattlemen, conservationists, and residents of thousands of square miles in all our western states. The word is CHANGE. It is a progressive change, accelerated in some regions and slow in others, but insidious in all. It affects every American citizen. The land itself is slipping away from millions of acres of our publicly owned territory. The vital topsoil itself is going, washing down the canyons, valleys, arroyos, streams, and rivers over hundreds of miles of territory from north to south. It is going as the water goes, not clear water any more, not reaching the sub-soil through seepage and absorption as it once did, not traveling slowly, but rushing over the surface—chocolate or red or yellow water carrying away the fundamental soil.

As one grizzled old-timer up in the Arizona Mountains remarked, "I don't know where the dirt goes to, but it sure isn't here any more." He pointed to a discouraged, rocky piece of land near by and said, "I used to have 30 head of cattle there, but the grass is all washed away. It's gittin' worse all 'round. Guess I'll have to move."

The answer to his problem was at hand. On the hillside above, six thin cows were attempting to gather some nourishment from the overgrazed countryside. That was the answer.

The change has been continuous for many years. It is caused principally by too many cattle and sheep ranging relentlessly up and down over forest and mesa, on mountainside, plain, and desert, in stream bed and on arid slope alike, browsing and moving, eating up the grass. Soil, thousands of years in the making, is disappearing because the grass is vanishing; roots no longer bind the earth's loose surface. Rains are carrying it away.

The onslaught continues as it once went on in sections of China, Africa, and Spain, and other over-exploited regions of the world, where grass, trees, and shrubs ultimately disappeared forever, leaving sandy wastes. Grazing animals are now attacking magnificent scenic regions of our own land—a quiet but relentless attack by tooth and lip. The disastrous results become more noticeable as years go by.

Despite the obvious depletion of soil on our ranges, there is agitation to increase the use of existing grazing areas, not to decrease them. This seems incredible, but it is true.

I journeyed more than a thousand miles to see the soil on its way to the rivers, from heights of 9000 feet to low desert areas where the story, with variations, was the same. Cattle and sheep were everywhere. The 2½-million-acre Tonto National Forest and adjacent ranges in central Arizona provided me with my clearest view of the problem. For days I walked and rode through different types of terrain, from the forested fir and pine regions of higher mountains, through the chaparral, and down to semidesert shrub and grassland.

My guide had traveled the region for a lifetime. I became familiar with such comments as "There used to be bears here years ago," or, "There were always quail on that mountain, but you don't see 'em any more." So it went as we drove through places with names to remember—Bloody Basin, Deadman's Mesa, Maverick Butte, Shirttail Springs, Graveyard Canyon, and numerous others.

I spent much time, literally on my knees, closely examining remnants of existing grasses in different sections, observing the all-important relation of root systems to soil binding, noticing how little clumps of grass and shrub in heavily overgrazed spots held the last topsoil where rains had washed away the intervening earth. Most impressive of all were areas that had been fenced by the United States Forest Service for study purposes. Some of the fences had been in place for as much as 20 years, others for 5 years or less. The contrast between grazed and ungrazed land, in all instances, was amazing.

In adjoining areas where cattle and sheep were able to feed, the ground was often actually bare, covered with loose stones, with only occasional mounds where long-suffering plants still hung on. Palatable shrubs were rounded and stunted, their projecting branches having been pruned year after year, until many had succumbed and permitted the earth, once held by their root systems, to give way under the impact of heavy rains.

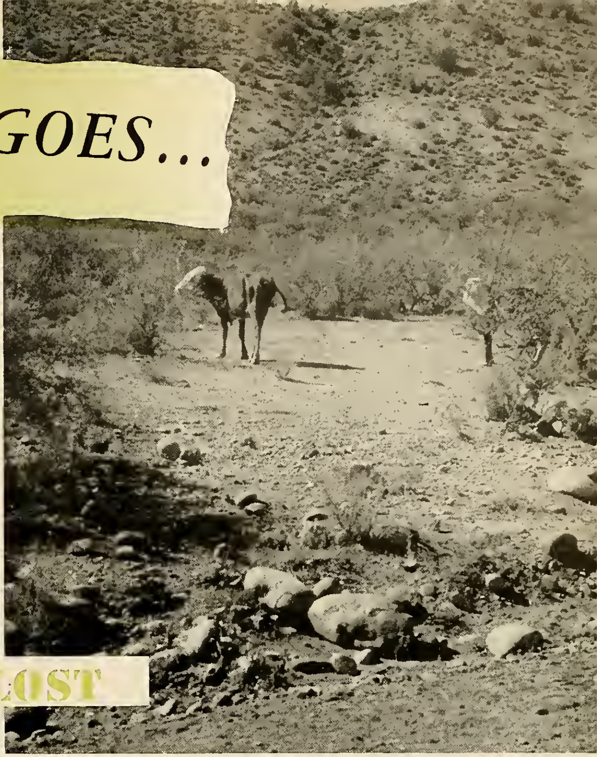
Fenced areas always presented a striking difference. In some places, grass was knee-high and edible shrubs were coming back quickly. In others, where hungry cattle had previously almost completely destroyed the plant life, there was a slow but noticeable growth after ten years of protection. The return of vegetation was not rapid in all regions by any means. Meanwhile, the wild animals naturally had suffered for lack of cover and food. In far too many areas it was a case

AS THE GRASS GOES...

Overgrazing by cattle and sheep is causing the grass to vanish. With no roots to bind it, the vital topsoil is carried away by rains. Only adequate regulations can save the range

GREEN TREASURE—LOST

ILVER BEARDGRASS flourishing in a fenced-off area. s uncommon sight would vanish in a couple of sons if unregulated cattle were loosed in the vicinity



▲ NO LONGER "HOME ON THE RANGE"—the continuous foraging of famished cattle and sheep, and heavy seasonal downpours, have robbed this land of its topsoil and protective net of roots

of "where the deer and the antelope *used* to roam." It was no longer "Home on the Range."

Many people logically ask why this condition is permitted to exist upon property that is owned by all our citizens. They want to know why the Government allows the land under its supervision to deteriorate so far that erosion has choked streams and poured silt into reservoirs that serve millions of people. Many citizens do not realize that the function of the Forest Service, for example, as defined by federal law, is to allow commercial use of areas under its supervision. Provision for private use of national forests was made in the original legislation that brought the regions under federal control. It would seem that a simple answer to this problem of a vanishing America would be to forbid any grazing within sections now being destroyed. But the affair is not as simple as it would appear.

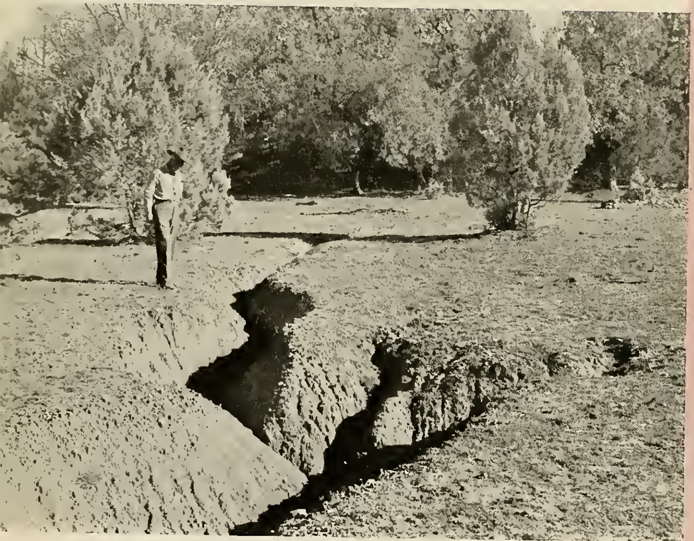
Practically all the lands were under use and well on the road to depletion through abuse before the Government stepped in. In areas in Utah, for instance, a person miles away could learn of the presence of sheep herds on distant mountain ranges by observing clouds of dust stirred up by the animals as they moved about. This was before the national forests were created, and because of prior occupancy, original settlers won the right to remain upon the land. Outsiders were granted usage privileges too. The grazing, cutting of timber, and mining of minerals continued. Regulatory precepts were agreed upon to provide safe and equitable management of forests and ranges for the betterment of natural conditions for the benefit of the private operator as well, but that was where the rub came. When the law conflicted with commercial interests, or vice versa, sparks began to fly, often all the way to the halls of Congress. Elected representatives from the areas involved would denounce this or that provision of the legislation because it injured the business interests of his constituents. Compromise sometimes resulted, with the consequence that cattle and sheep went right on browsing and the soil continued to flow down the mountainsides.

Fortunately, there are a number of far-seeing men who have been in the employ of the Federal Government for years. These men insist upon performing their duties in strict accordance with their instructions. When areas are obviously being damaged by overgrazing, the cattlemen are advised to reduce their herds. Loud shouts are usually heard, as pocketbooks, often large ones, become pinched. Cries are raised that the "Government" is endeavoring to ruin the businessman, when actually the conscientious public servant is trying his best to manage what re-

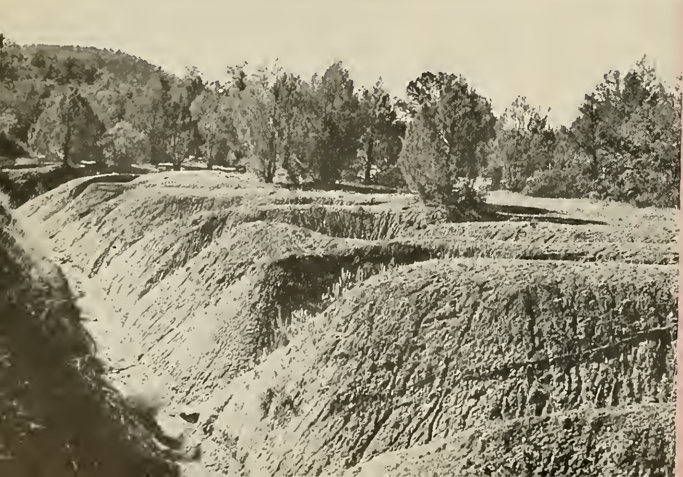
THE BIRTH OF A CANYON

▲ Torrential rains have started washing away soil no longer anchored by grass roots

▼ Rich, valuable earth vanishes before the eye as weather cuts deeper into this once-fertile meadow



▼ A shameful example of killing the land resources: a 15-year-old arroyo cutting a great gash across the surface of the earth



mains of the land for the benefit of all.

To illustrate how the permit system works on our federal ranges: about 103 stockmen pay the Government a nominal fee for the privilege of grazing some 30,000 head of cattle in designated areas in the Tonto National Forest. The highest permit is for 1631 head, the lowest for 5. The cattle are scattered through every conceivable type of terrain within the area, sometimes in regions that would seem to be inaccessible even to mountain goats. All of the animals are there due to provisions under which the Forest Service was established in this region in 1906. Grazing here has been in effect for more than 80 years, with and without any attempt at range improvement.

According to the Forest Supervisor of the Tonto area, the land was not so critically bad 40 years ago, when it became incorporated in the National Forests. Overbrowsing has weakened the plants and reduced their density so that here and elsewhere the more palatable species are fighting a losing battle over thousands of square miles of range country where grazing continues. The supervisor, Lee Kirby, has been with the Forest Service for nearly 40 years, and he is a

▼ Browsed to a hedge. This level lan has lost four to nine inches of topsoil withi the lifetime of the plants shown here

true crusader for the preservation of the land through common sense and scientific co-operation with nature. He has lost friends of long standing in his effort to manage properly the multiple resources of the region. He receives the strong backing of his superiors and is a fearless person who steps in where many would hesitate. Kirby says that some of his opponents are as sincere in their opinions as he is, while others frankly state that the future is of no consequence to them and that the next generation will have to look out for itself.

In several instances I talked with cattle owners and found that, while they agree that "something is happening to the range," they express the opinon that there is "nothing that a good rain would not correct." Others remarked that as long as the cattle were fat all was well, regardless of the devastation caused. The truth is that on some of the lands today, rains do almost as much harm as good, through soil removal. Not all of the cattle are "fat," either. Several stockmen, who have seen the light, voluntarily placed their range areas "at rest," removing the animals and giving the region a chance to recuperate. These men, unfortunately, are exceptions to the rule.

The mountainous and desert region of the Tonto is the principal watershed for the Salt River and the huge Roosevelt Reservoir, which supplies thousands of domestic and agricultural users. Silt is filling the reservoir. One of the glib replies has been that as the reservoir fills up, the dam can be increased in height! This reasoning is typical of the failure to examine the problem realistically. If grass and other plants upon the watershed were permitted to grow, thus holding the soil in place, the silt problem would in a large measure be brought under control.

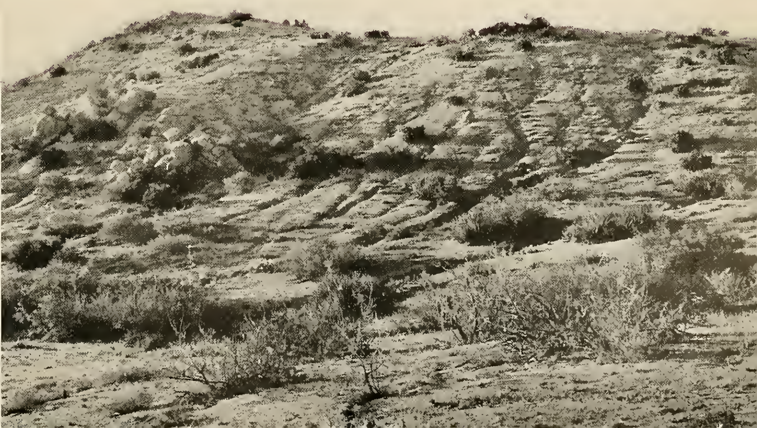
In numberless instances I saw where grass and shrubs had somehow taken root and had stopped the formation of ditches and gullies. Just outside a fenced section, one would often see an open wash that had gullied deeply and was removing considerable quantities of the topsoil, while inside the fenced area, healthy plants had arrested the ditching. Many of these deep ditches were in open forest glades, far up in the mountains, as well as in the lower regions, and a number were of recent occurrence.

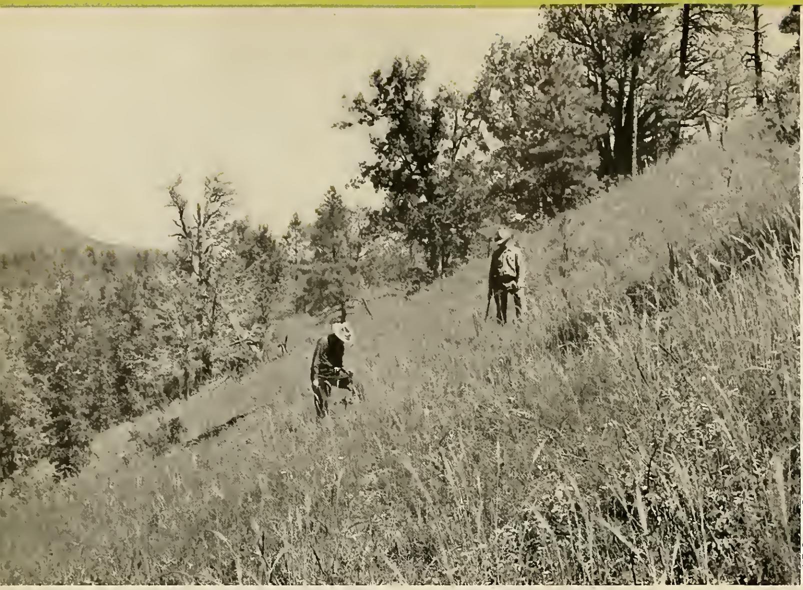
According to Forest Service officials, conservative grazing in some areas will actually benefit the country, provided that it is properly managed. But overgrazing should certainly be stopped, particularly in regions where harm is being done. The Forest Service does all it can to encourage the natural growth of cattle food and the proper management of the range. But when the grass goes, the shepherd and herder must give the misused land a chance.

The policies of the Forest Service also include recreational aspects of the land, wildlife problems, and related scientific research. An outstanding contribution to the public is rendered by an institution tucked away in a deep mountain canyon in the heart of the Tonto. Officially known as the Sierra Ancha Experimental Forest, it is concerned with the study of the surface of the land, the water that flows over and through it, and the plants and animals that live upon it. The leading objective of the experimenters relates to the vitally needed rehabilitation of a still magnificent country that is fast losing its vigor. Results of the work are of a far-reaching significance the country over. Much of the future welfare of our people, both physical and economic, depends upon the successful application of principles and procedures discovered and made known at this pioneer scientific establishment and

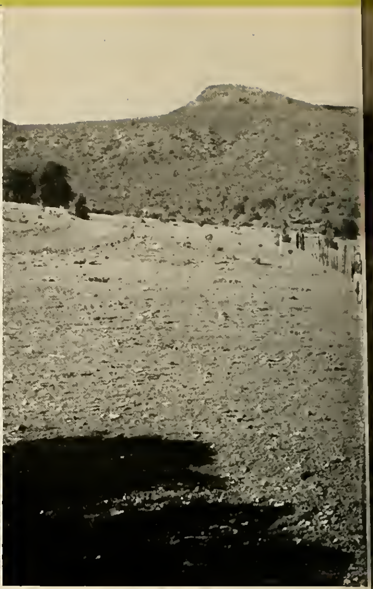
OVERGRAZING

▼ THE ROOTS that anchor the shrubs have given way, and most of the precious loam has been channeled down innumerable hillside gullies





▲ ADMIRABLE RESULTS: re-seeding and nine years of protection produced this rich growth on originally overgrazed land



▲ NOT SO ADMIRABLE RESUL
if the area outside the fe

at other kindred organizations throughout the United States.

Perhaps the best way to tell of the work of this station is to go back to a summer day in 1939, seven years after the program had been initiated. It was about mid-afternoon. Dark gray clouds had given way to black, and the sun no longer warmed the recesses of the canyon. An increasingly strong wind whipped through the tree-tops, and soon sharp drops of rain spattered the dusty oak leaves. From all indications, exceptionally heavy weather was in the making. Very shortly there was no doubt about it. The downpour actually started at about 4 o'clock and proved to be one of the most torrential storms on record. Water cascaded in blinding sheets, pouring off mountain surfaces in rivers. More than 5 inches of rain fell in less than 2 hours.

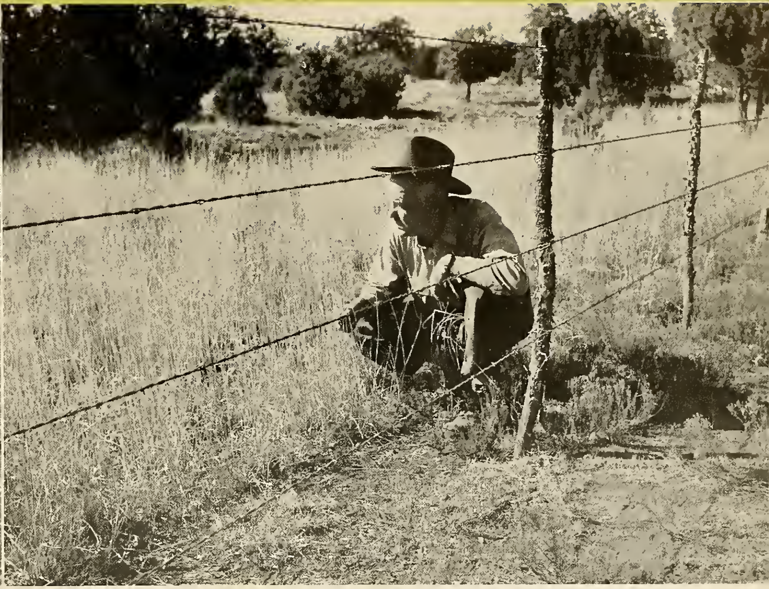
On neighboring mountain slopes and mesas were a number of sturdily built contrivances, designed to record events of all sorts that might occur during any weather disturbance. Some of these were placed within fenced areas, others in the open. The instruments certainly received a test that afternoon. There were mechanical recording devices to measure the minute-by-minute depth of rainfall, the amount of run-off and absorption, and—perhaps most important of all—the quantity and type of soil that was washed away. Some of the measuring appliances were located where grass and shrub growth was good, others where the ground-cover was poor, and still others where there was practically no plant growth.

The swiftly traveling water was directed into concrete runways, where it found its way into receiving buckets or deep trays, built to measure the quantity of surface and subsurface run-off. The trays would fill and then tip over, and automatic instruments recorded each movement. The receptacles filled with amazing rapidity as the water surged in. Sensitive registering pens, pressed constantly upon slowly moving, paper-covered cylinders, received the actual impulse of the trays as they crashed rapidly up and down. The roar of water rose and fell as the storm varied in intensity. Thunder rolled along the mountain crests and fairly shook the instruments.

With the water came soil and other debris. There was machinery to measure the amount of this material too, for a chief objective of the researchers was to study this priceless substance from the ground surface. Mud and rocks, loosened by the currents, came flowing and tumbling into the recorders until it seemed the instruments must certainly be overtaxed and cease to operate. The bedraggled men walked and rode from one battery of machines to another, from the ones on steep slopes to those situated on more moderate inclines, watching anxiously lest any mechanical breakdown cause the loss of information vital to future plans to lessen erosion. Even a very brief failure of one of the many devices would mar the ultimate result.

The most telling story had to do with local differences in the type and quantity of soil in the receiving basins. On areas disturbed by cattle, the measuring apparatus often showed as much as 85 per cent more loss of soil than in places where grass grew luxuriantly. In one area the flood, unimpeded by any protective plant growth, actually cut a completely new channel

grazed a few years longer,
uld be beyond recovery



▲ NOTE THE STARTLING CONTRAST between the outside and inside area, here observed at close range by Lee Kirby, Supervisor of Tonto National Forest

3 feet deep and 6 feet wide during that one storm. Entire trees were washed away. The onrushing tide searched out their root systems and toppled them over. Boulders weighing tons were released from their age-old beds to plunge down, carrying all before them. Fortunately none of these massive rocks struck the buildings housing the recording machinery.

Fenced and protected areas showed practically no damage in comparison with the raw and ruined ground where too much grazing had removed the cover.

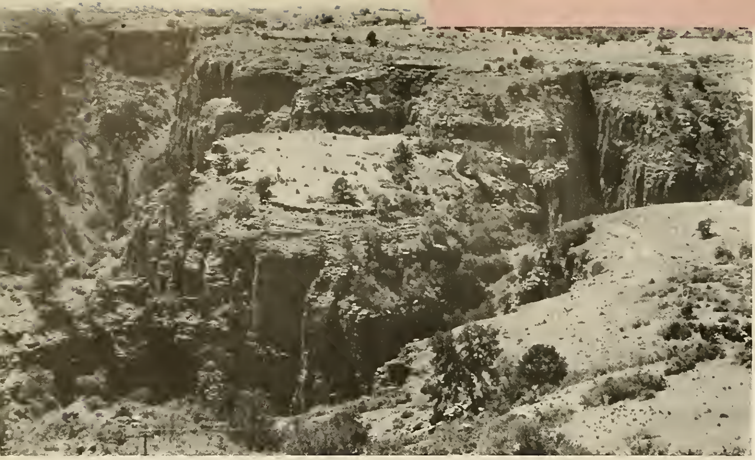
This unraveling of the earth's surface is not a nice thing to watch. Between dashes to the scattered instruments the scientists stood beneath the shelter of buildings and observed the destruction in progress. The late C. K. Cooperrider, senior range examiner of the Southwestern Forest and Range Experiment Station and one of the principal founders of Sierra Ancha Experimental Forest, was one of those present. He later stated that the total amount of damage caused by the rain on overgrazed areas was appalling. He had accomplished much toward a detailed understanding of the results of misuse of the land before he was forced to leave the scene of his endeavors forever. He it was who braved the downpour and led the group to examine the instruments throughout the 13,000-acre region devoted to the experiments.

Raymond Price, present director of the Southwestern Forest and Range Experiment Station for the Department of Agriculture, is the chief of this work in the entire region. He is a typical zealot and devotes all of his strength and time to this activity. In direct control of Sierra Ancha is Dr. William P. Martin, who is another sincere worker for soil protection and wise watershed management. These men and their associates hold posts of great responsibility and importance, for it is their duty to furnish information that shall be the basis of management for federal, state, and private forest, range, and watershed land.

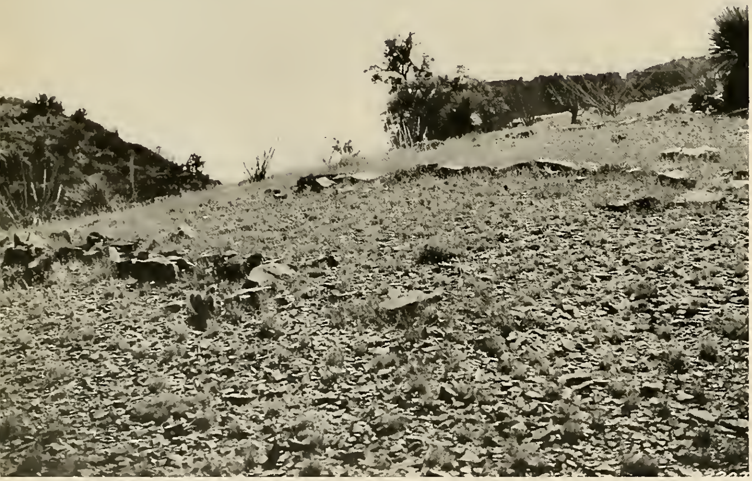
There is room for reasonable grazing, but when the point is reached where more forage is being eaten than can be replenished, corrective measures should be taken regardless of whose toes are temporarily stepped on in the process. Either this should be the policy or else the laws should be changed. Far too much damage has been done to our national resources by legalized acquisitiveness. It is time the deterioration of the land be halted.

One of the sad things, as Supervisor Kirby points out, is that the destruction is often so gradual that it is scarecly noticed until too late. Experienced and trained range technicians are necessary to discover these changes in time and work out remedies. America depends upon much of this western range for its beefsteaks and lamb chops. If a relatively few citizens are to be permitted to destroy the goose that has laid so many golden eggs for so many years, surely the majority should have something to say as well as the minority.

Unless cattle and sheep raisers look to the future it is really a question as to how long their region can compete with other parts of the world. Immediate steps, based on scientific research, must be taken to protect, preserve, and bring back the land. Otherwise the useful

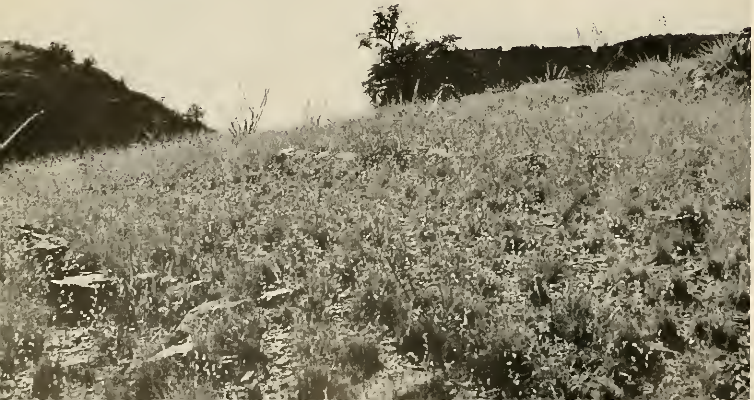


▲ THIS TABLELAND, rising 1000 feet from the canyon floor, could be reached by cattle only by a narrow neck of land, which was fenced to study recovery possibilities



▲ OVERGRAZED TOP LAND on the mesa—1935

▼ TEN YEARS OF PROTECTION and the soil was bound by healthy grasses



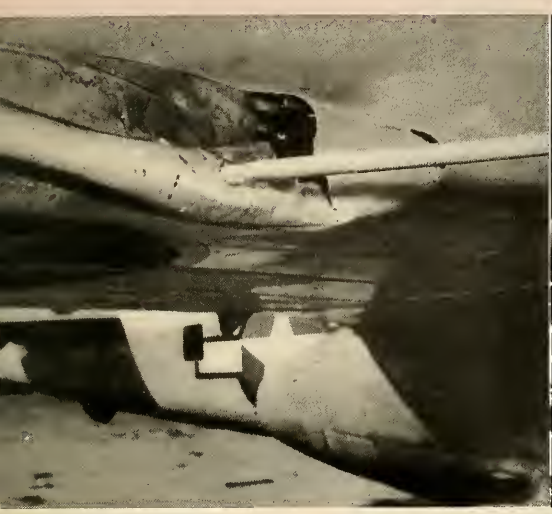
ranges will have vanished. They are vanishing today.

The Sierra Ancha Experimental Forest stands as a landmark in the wilderness to direct the attention of those who would better the land in which they live. Today, many years after the memorable storm, the station continues to function, still compiling information of many types and of increased usefulness. Eastern communities have a large stake in the proceedings, yet the vast majority of the citizens who pay the taxes are totally unaware that any problem exists.

Cattle flourished in the West in days gone by, and men died with their boots on in the struggle over possession of grass and more grass. Those of us who are interested in the well-being of our "last frontier" would do well to acquaint ourselves with the facts and the solutions science offers. It is a human problem as well as one in wildlife and plant conservation. Individual rights undeniably have to be considered. It is a matter of hard, practical reasoning—not sentiment. In the Old World it is a very ancient struggle and it has been fought to its logical conclusion: either workable and adequate regulations of grazing privileges have been evolved, or the range has been lost.

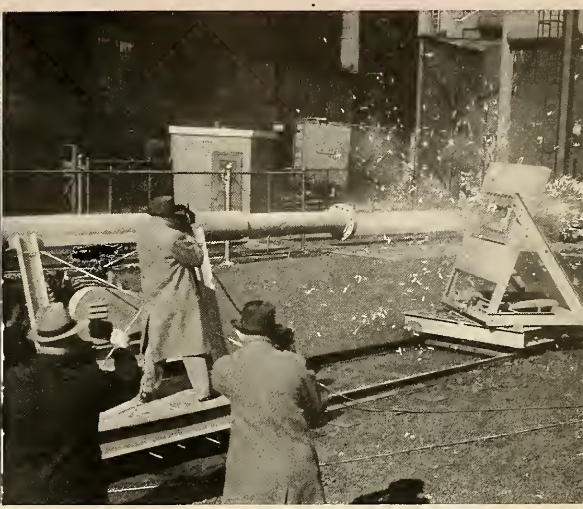
Certainly the user of water, the recreationist, and the lover of the out-of-doors deserve consideration too. The present generation of commercial operators of our ranges will prosper to a limited extent, but it should be recalled that a great war has just been fought and won to protect coming generations from want and privation. Young people of today and tomorrow are going to pay for that war. They fought hard for the preservation of our country as a whole; should they not have the assurance that vast areas of that same land will be maintained in a productive state? After men's efforts have so long been turned to the development of destructive devices of unbelievable magnitude, is it not time for the public to give recognition and individual thought to a determined effort to re-create and rehabilitate the land?

BIRDS vs PLANES



CAA photo, U. S. Dept. of Commerce

▲ **Damage** to the leading edge of an airplane wing caused by collision with a vulture: a view from the China-Burma frontier, where plane accidents of this sort have been frequent. Adjustment of plane routes and altitudes to avoid migratory birds has been recommended



Westinghouse photo

▲ **Experiments** in the development of a bird-proof windshield for planes. This compressed air cannon 20 feet long was used to simulate the impact of a flying bird on test windshields of various types. An improved glass withstood collision with a 15-pound bird at a speed of 200 miles an hour or more

When air lanes cross the migratory routes of birds, death rides the skyways

By Frank W. Lane

FROM the earliest days of human flight there have been occasional collisions between birds and airplanes. The oldest reference I have been able to trace dates from about 1910. A man was flying at Long Beach, California when a seagull hit his machine and became wedged between the fin and the rudder, which became immovable. The plane crashed and the pilot was killed.

A number of collisions were recorded during World War I, but it was not until World War II, when vastly more airplanes were flown than ever before, that the problem assumed serious proportions. Today birds are a world-wide hazard to flying. I have records of birds proving a danger to aircraft in the Arctic, Antarctic, in the Pacific islands, the Americas, Africa, India, Europe, and at sea.

The total number of airplanes damaged or totally destroyed through collisions with birds will never be known. It is almost certain that a number, perhaps a high proportion, of unsolved air disasters have been caused in this way.

In 1944, U. S. airline pilots were reporting collisions with birds at the rate of two a week. It is known that during the migration seasons the rate is higher. When the accidents to military aircraft throughout the world are added to these figures for American civil airlines, it is obvious that the bird-versus-airplane problem has today reached serious proportions. In fact, *Time* reported in 1944 that the bird-bumping problem was becoming so troublesome that airlines rated the Civil Aeronautics Administration's windshield-strengthening experiments the most urgent research project.

While the larger birds are the greatest danger, quite small birds can cause appreciable damage. A sparrow hit the windshield of a big Army observation plane and crashed right through, causing the pilot to make an emergency landing on a highway.

When collisions occur with flocks of large birds, serious damage to both birds and occupants may result. During a bombing mission from England in September, 1942, some of the machines ran into a large flock of wildfowl. The damage caused was so serious that several of the aircraft had to return to their base, their bombing mission unaccomplished.

But it is not necessary for airplanes to collide with flocks of birds to be severely damaged. A wild duck that crashed into the cockpit of a RCAF flying boat hit the pilot in the face, stunned him, and caused the machine to crash-dive into the sea.

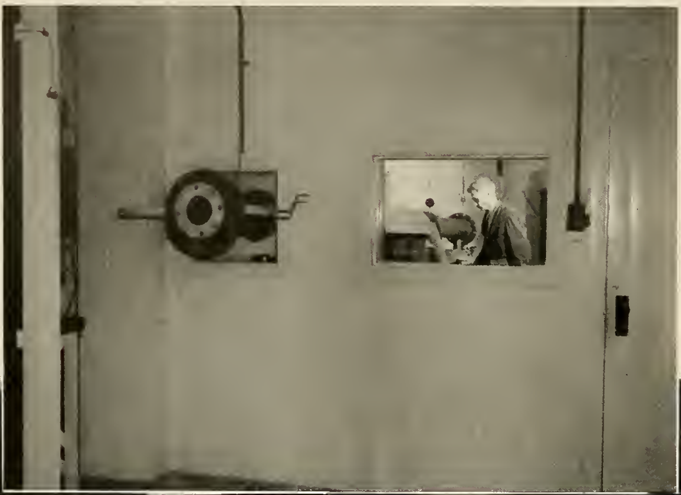
The hedge-hopping technique adopted by our pilots during one phase of the operations against Occupied Europe was responsible for a sudden increase in bird-versus-airplane encounters. When the crew of one bomber entered the interrogation room after a raid, all had feathers in their caps. The decorations came from a covey of partridge that had struck the aircraft over France.

Sea birds have proved a nuisance, if not a definite menace to aircraft-carriers. They perch on these ready-made islands and sometimes peck at the fabric on the wings of the waiting aircraft. Holes are thus made and the airworthiness of the machines may be affected.

During World War I some French pilots would take off with a bag of bricks in the cockpit. Their idea was to try to throw one of the bricks into their opponent's propeller. Two German aircraft were said to have been brought down by accurately heaved bricks. The casualties among ground personnel from bricks that missed their objective is not stated.

An even more novel suggestion for air-fighting emanated from France early in the same war. This was that eagles should be employed to attack enemy aircraft! In fact, six eagles were said to have been specially trained for the purpose. They were first accustomed to the noise of propellers and guns. Then pieces of meat were hung on model balloons in an attempt to get eagles to rush at them—as it was hoped they would rush at enemy aircraft.

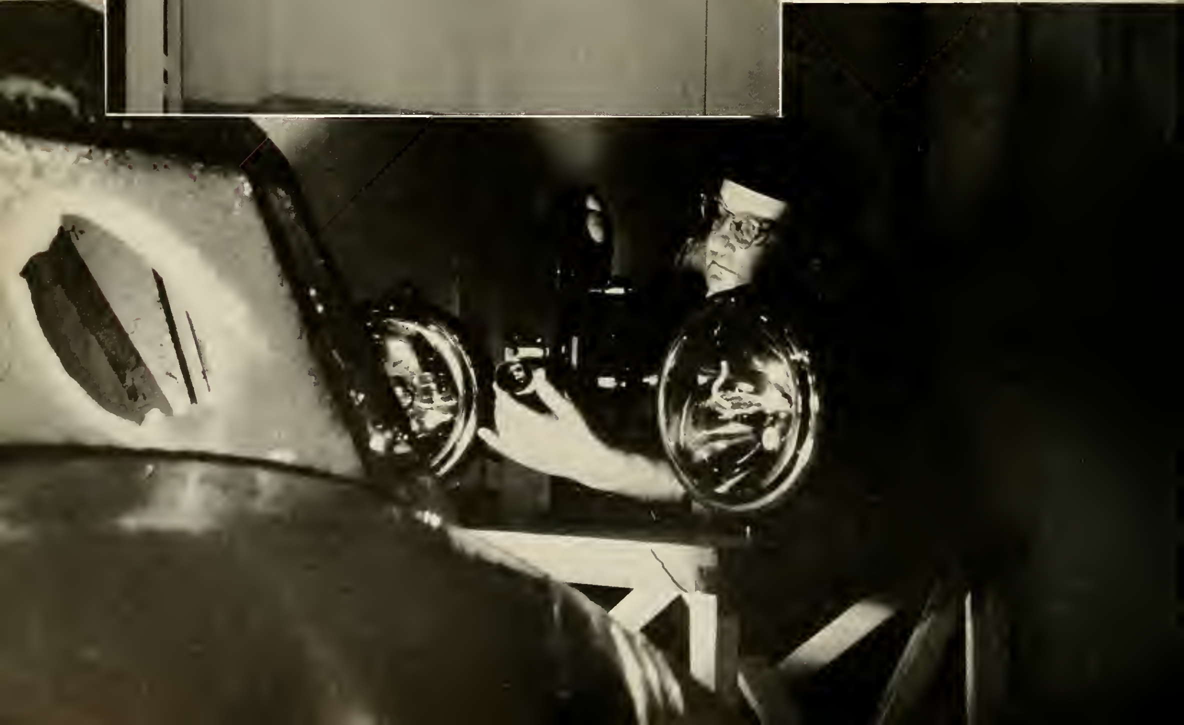
CAA photo, U. S. Dept. of Commerce



◂ Equipment used at the Indianapolis Experimental Station included this "bird gun." The muzzle projects through the wall at left. The load-breech is seen through the window

▾ Standard windshield after a 4-pound chicken had been shot through it at the CAA Experimental Station in Indianapolis. High-speed movies helped to study the reactions of various windshields to collision

CAA photo, U. S. Dept. of Commerce



An aeronautical journal in Paris commented on the eagle experiment as follows:

> "There is no airplane, and above all, no dirigible, which could withstand such an attack. Given the rapidity of an eagle's flight, and the strength of its beak and claws, there can be no doubt that a company of properly trained eagles could annihilate, in a few seconds, the most powerfully equipped aerial fleet."

The French officers who trained the eagles did not subscribe to this view. Apparently their idea was that if the birds could be trained to distract enemy pilots, the machines might be brought down through loss of control.

It appears that of all birds eagles are the most prone to attack aircraft and the most dangerous a flier can encounter. In this connection it should be remembered that eagles weigh up to fifteen pounds and in a stoop may touch 200 miles an hour.

The danger from eagles and other large birds was officially recognized by the British Air Ministry in 1934. A warning notice about them, issued to all pilots in the Near and Middle East, said:

> "Only one rule can be given for the general guidance of pilots. Since the birds referred to invariably dive when alarmed, attempts to avoid them should be made not by endeavoring to pass beneath them, but by changing course."

All the reported attacks of eagles on airplanes may not, of course, have been deliberate. A number, perhaps the majority, may have been the result of panic. But there are some instances that appear to have been deliberate attacks.

The most remarkable instance of eagles attacking an airplane is reported by J. Wentworth Day. The machine was a three-motored all-steel passenger airplane owned by Prince George Bibesco. When it was flying near Allahabad two eagles stooped on it. "The first flew straight into the middle engine while the second dived from 10,000 feet and went through the steel wing like a stone, ripping a great hole."

Eagles are not the only birds that have been reported to make deliberate attacks upon airplanes. Sir Hugh Gladstone, writing of World War I, says:

> "Jackdaws were observed, in a French town, to leave their homes in the steeples and throw themselves upon airplanes, clinging to them and attacking them with their beaks as if to drive away these gigantic and unknown birds of prey."

It seems to be the general opinion of pilots today that birds are very little disturbed by aircraft when both are in flight and when the birds are not being harassed in any way. If an airplane approaches them closely, they usually wheel leisurely out of the way. There have been several reports of birds flying alongside the pilot and peering into the cockpit of planes flying at lower speeds.

It is interesting to note that balloons appear to create far more consternation among birds than airplanes do. One balloonist said that most birds seem to go mad when the silent shadow of a balloon falls on them. Pigeons fly wildly to and fro in swarms, and

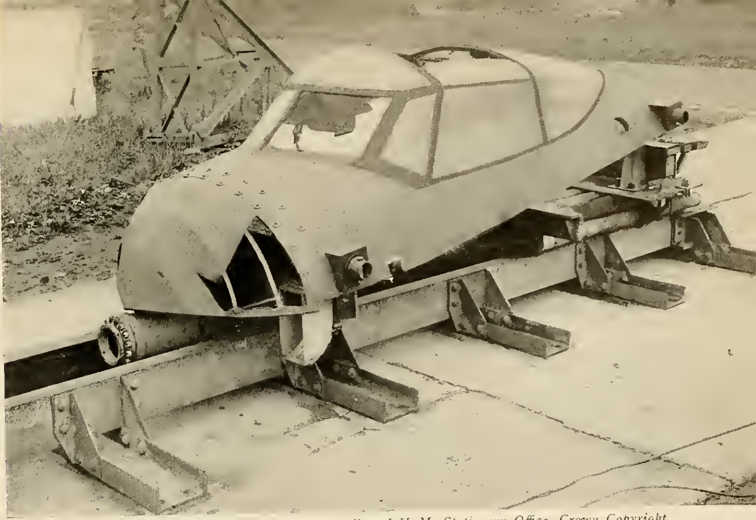
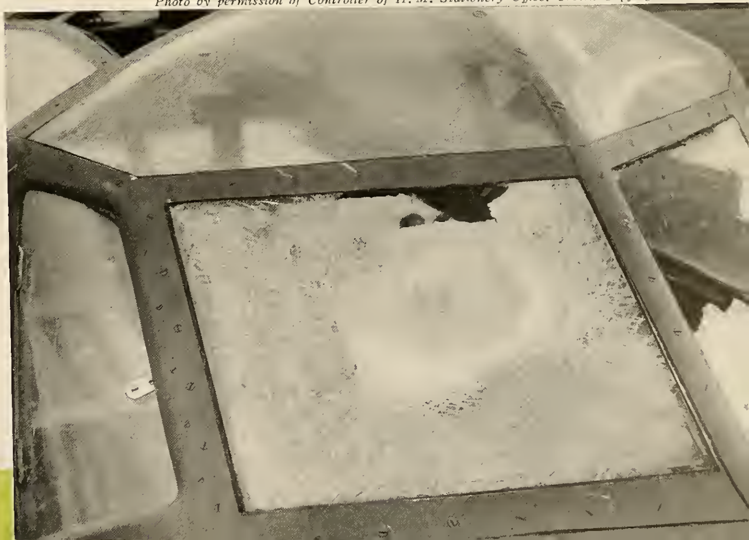


Photo by permission of Controller of H. M. Stationery Office. Crown Copyright

▲ Windshield tests in the British Isles used a section of a plane mounted on tracks and propelled by rockets, visible at rear

▼ One rook at 234 miles per hour rendered the starboard windshield opaque; two at the same speed penetrated the port windshield

Photo by permission of Controller of H. M. Stationery Office. Crown Copyright



fowls cackle and make for the nearest cover.

The main peace-time menace to airplanes is during the migration seasons. The danger is especially acute where commercial airways cross the centuries' old flyways used by the birds. As most migrating birds fly at night (they eat and rest during the day), bird and pilot are less apt to see each other in time to avoid collisions.

Pat Curtin, an experienced pilot of American Airlines who is especially interested in this problem, makes the following suggestions for lessening the risk during the migration seasons:

> "If, for one migration season, all the airlines asked their pilots to report all migratory flights of birds and include the altitude they were observed at, the area they were over, estimated wind direction at that altitude, and the approximate direction the birds were headed at the time, it might be possible to learn enough about the habits of the birds to reduce the number of bird strikes on aircraft by more than half."

Radio-location, or radar, may be developed as a means to lessen the number of bird-versus-airplane accidents. Experiments were being carried out last year in England with a view to fitting a collision-warning device, using radar equipment, to the instrument panels of airplanes. Another suggested use for radar is as an aid in plotting the migration habits of birds. The results may help the airlines to reroute some of their airplanes during the migration season to avoid colliding with the main stream of migrating birds.

Although airplanes may be struck on almost any part, the windshield appears to be the place where collisions occur most frequently. This is, of course, the most vulnerable place, because the pilot is immediately behind it. Aeronautical engineers have therefore devoted a good deal of time, effort, and ingenuity to the construction of bird-proof windshields for aircraft.

The Bureau of Standards, the National Advisory Committee for Aeronautics, and the Civil Aeronautics Administration in the United States have been chiefly responsible for this work. Toward the end of World War II the Ministry of Aircraft Production in England conducted its own investigations on the subject. I had the privilege of playing a minor part in the Ministry's investigations by supplying information on the speed, weight, and height of flight of birds likely to be encountered by pilots flying over and around the British Isles.

From the point of view of the investigators a bird was a "liquid object in a fragile container" which annihilated itself at high speed against the glass. In the earlier experiments a standard bird was assumed to weigh about four pounds and to collide with the windshield at a relative speed of 270 miles an hour—200 for the airplane and 70 for the bird. Such an impact would mean that about 10,000 foot-pounds of energy would have to be dissipated by the windshield. If a bird weighing 20 pounds, such as a swan, crashed against it at the same speed, there would be a pressure of over 100 pounds to the square inch on an average commercial aircraft's windshield, which means that a total energy of approximately 50,000 foot-pounds would be expended against the windshield. It is not surprising that the windshields in use when the experiments started were frequently shattered by birds.

The investigators were faced with the initial difficulty of simulating the actual conditions. Objects of various weights were first made up to take the place of birds. These "birds" were propelled from a two-inch air cannon or from a five-inch AA gun at various windshields.

The more recent tests, carried out at the Westinghouse Electric and Manufacturing Company's plant at East Pittsburgh, have all been made with chickens and turkeys weighing from three to seventeen pounds. The birds were painlessly electrocuted immediately before the tests and then put into light cloth bags. It was considered that for test purposes a seventeen-pound turkey could take the place of a twenty-pound swan (with the exception of condors, swans are the heaviest encountered), as the wings of the swan would extend beyond the boundaries of the windshield.

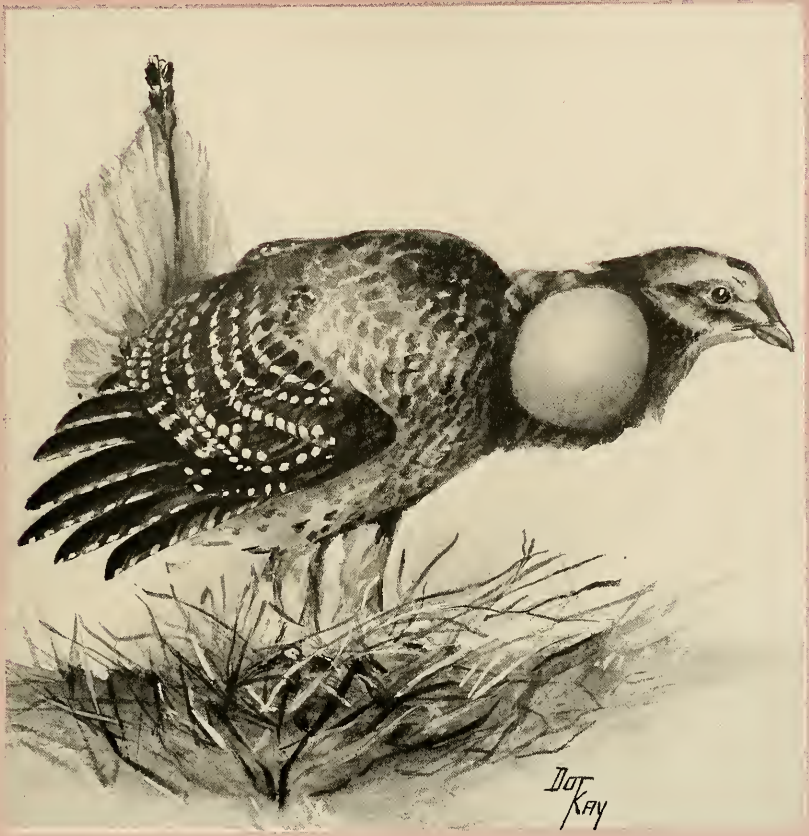
A compressed-air gun was used to project the bird carcasses at the test windshield. Two interchangeable barrels, five and eight inches in diameter and 20 feet long were used. The speed of projection could be varied between 50 and 450 miles an hour. The dynamics of the impact between the carcasses and the windshields were studied by the use of a 35-mm. high-speed cinematograph camera taking 1500 pictures a second. Various electrically operated gauges and oscillographs gave additional data on the tests.

These experiments with actual birds showed that the conventional quarter-inch safety glass windshield collapsed under the impact of a four-pound bird projected at a velocity of 75 miles an hour, which is less than the normal landing speed of modern commercial aircraft. Even when the windshield was not penetrated, its transparency, and therefore the pilot's vision, was impaired through the shattering of the glass face. And large quantities of very dangerous glass splinters were thrown off the rear face of the shield at a speed of about 350 miles an hour.

After a number of tests with various types of experimental windshields were made, it was found that one made of laminated glass-vinyl with extended plastic edges and other strengthening devices, having a total thickness of about three-quarters of an inch, would resist the impact of four-pound carcasses projected at 300 miles an hour or a fifteen-pound carcass at 200 miles an hour.

Other measures that have been considered include the installation of two separate panes of glass, one behind the other, and the use of smaller panes in the windshield with more strength per unit. Further consideration has indicated, however, that within limits a larger pane, being more resilient, is more bird-proof. A metal grating which can be dropped over the windshield and a protecting shield for the pilot to cut up the birds before they crash into him have also been considered.

THE *Vanishing* SHARP-TAIL



By Will O'Gara

With photographs by the author

IN the dimness of the night's end we heard the first resonant *yee-ownk* that signified the beginning of the sharp-tailed grouse's mating dance. It was answered immediately by several other cocks and followed by a pattering as they vigorously stomped. Their vibrating tail feathers made a clicking sound like that of a dozen old-time moving picture machines in operation.

Peeking out through slits in the burlap blind, we could make out in the semi-darkness half a dozen male birds, ghostly in the mist that hung over the frosted ground. It was ten minutes past five, and the bare popples across the meadow glistened in the last cold rays of the moon. For although it was April, spring comes late in central Wisconsin's marshlands.

Soon the age-old springtime mating performance was in full swing. The cocks spread their wings out rigidly in a downward arc, with every primary feather extended. The tail, normally down, was now turned straight up, revealing the snow-white under coloring. Above their eyes a bright yellow half-moon of skin, normally unexpanded, was visible.

An early-morning trip to Wisconsin's frosty marshlands gives one a "grand-stand seat" to one of nature's most interesting mating performances

With head outstretched, they traveled across the knoll. Then ceasing to move forward, they continued to stomp stiff-leggedly so rapidly that the eye could barely follow the movement. Again they went ahead, their pattering feet providing a movement that gave the impression of a boat sailing across a grassy sea.

This sailing and the clicking of the tail feathers was accompanied by a low, melodious note like the "pung" of a cork being pulled from a barrel at the other end of a cellar. In order to make the sound, the grouse drew in his head and shot it forward, partially deflating the expanded boomsack. Unlike the other noises of the sharp-tail, it was audible for only a few feet.

As it grew lighter, we frequently saw a dancer pause, beak down, wings outspread. On either side of the throat a purple patch of skin swelled from beneath the feathers until it was the size of a small apple. (Although the feathers make it look like two boomsacks, there is only one.) When the bird deflated the sack, we heard the booming that served to call the hens to the grounds. On quiet spring mornings the practiced ear can detect this call up to a distance of two miles.

It is of two types. Sid Gordon, one of Wisconsin's outstanding naturalists, says that one is like the nasal groan of a man who has received two quick and hearty punches in the stomach, and that it should be written as *unh . . . unnh.* It is most often given with the head down. The second type is a sharper gobble sound, also nasal—*anh . . wook.*

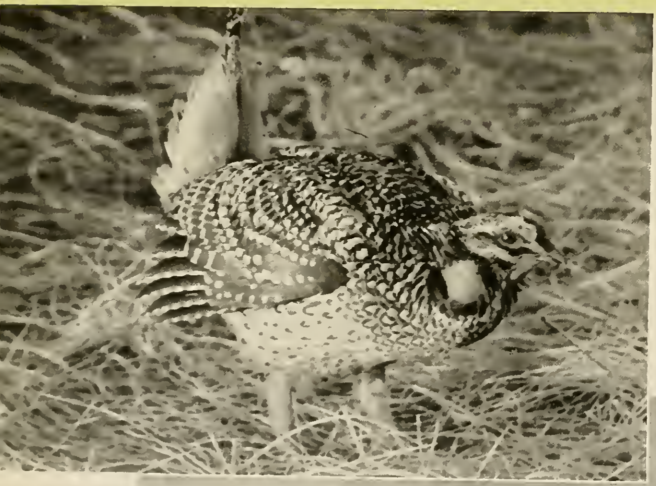
The spirit of spring

On early spring days, the marsh hawk swoops with graceful power and seeks to charm his lady. The red-winged blackbird establishes by right of might a singing spot in which to woo his mate. Most animals, in fact, have some special display to attract the opposite sex. But to me, the energetic and noisy pre-breakfast dancing party of this brown bird of the brushlands is unequaled among all of them.

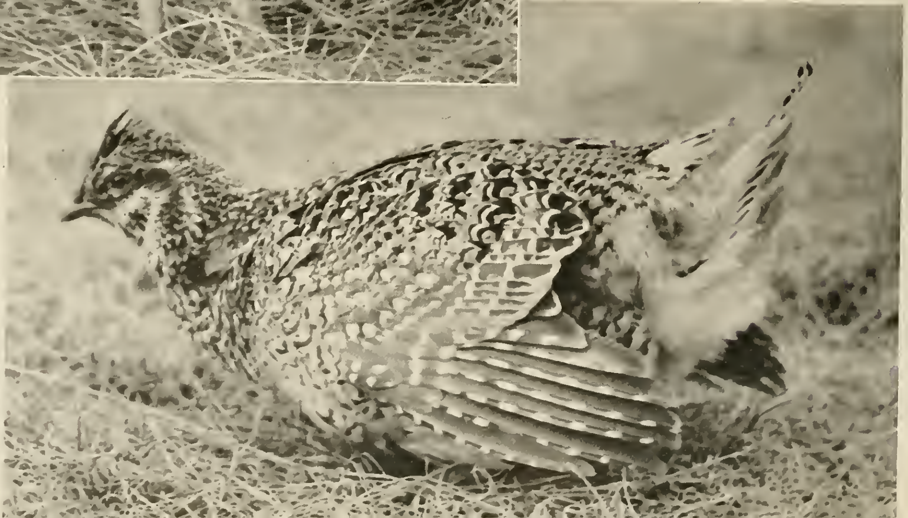
It is the seemingly indifferent hen that controls the unison of the annual extravaganza. Upon her arrival, a sporadic and indifferent exhibition changes into a frenzy of co-ordinated activity.

When we first began to watch the grouse several years ago, there were many birds at each dancing ground. But now the environment of the prairie grouse is vanishing, and his numbers are sadly depleted. Where once 30 or more birds came to the grounds each morning, we now find a half dozen males and a female or two. Formerly the hens would arrive with the pack. Now their arrival is usually later. And, like men, the sharp-tail males don't display half the enthusiasm, nor are their efforts synchronized, without the female.

The dance begins in late winter and ends in June, with a peak of activity in May. It begins in the dull gray before dawn and lasts, depending upon the duration of subdued light, for more than three hours. Frequently the birds perform in the late afternoon. And although many persons may discount the memory of birds, the sharp-tails always find the same spots each year. In one meadow near Babcock the grouse has been dancing each spring for at least 42 years, according to long-time residents.



◂A SHARP-TAILED GROUSE filling his boomsack with air, preparatory to booming



▾BOOMING COMPLETED, the bird moves away. The raised head feathers indicate fear or anger, probably resulting from the movement and noise in the observer's blind, only three feet away. Sharp-tailed grouse show keen hearing

This is within an area once known as the finest chicken hunting ground in North America. Babcock lies a little north of the middle of ancient Glacial Lake Wisconsin. Geologists say that once a great lake covered the central part, in some places 70 feet deep. And it was where this prehistoric lake once lay that pioneer residents, through a combination of logging, farming, and widespread burning of the land, produced an ideal habitat for extraordinary populations of prairie chicken and sharp-tailed grouse.

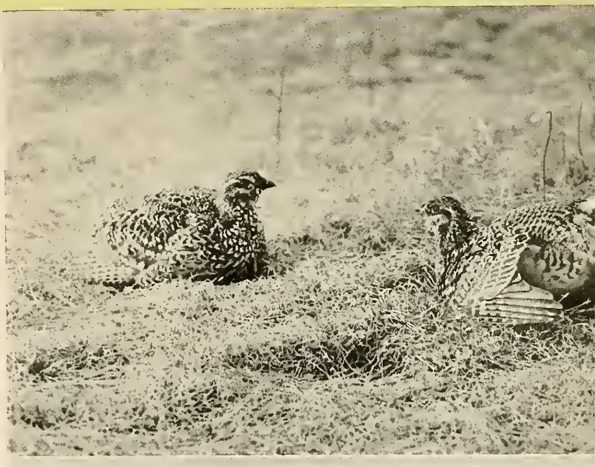
Early settlers found the great swamp of central Wisconsin an area of peat bog marshes (the remnant of the 300,000-acre lake), interspersed with sandy "islands" and ridges. The upland was dominated by pine and oak. Blue joint and wire grass waved over great marshes; tamarack and spruce swamps were common. There were some grouse, and passenger pigeons favored the territory as a nesting ground.

Timber cutting produced greater openings for the grouse. Farmlands provided quantities of fall and winter food such as buckwheat and corn, and a profusion of smartweed and ragweed, all of which are relished by the birds. Widespread fires kept the brushland from reverting to tamarack, spruce swamps, and upland woods. The fires also produced, on some peat areas, a reversion from grass to weed-type vegetation that was an ideal cover and food supply. And they forced out the predatory enemies of the birds—pine snakes, skunks, brush wolves, foxes, and hawks.

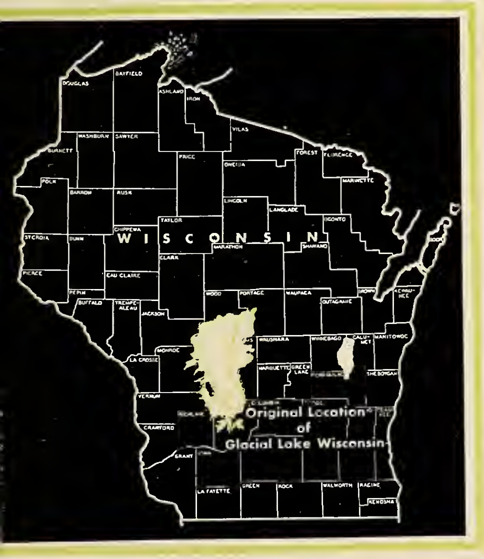
In this sterilized, vermin-free environment the prairie grouse flourished as nowhere else on earth.

Early in the mating season each cock bird establishes a portion of the traditional grounds as a dancing spot of his own. This is done with fighting and considerable bluffing of the other fellow, for the sharp-tail is quite a threatener. On these personal areas, the owner performs so often in one particular run that the grass is beaten down along it. At the end of each runway he will have a rounded stopping spot, where he often will meet with his neighbor and face him in a belligerent fashion. The two birds cackle and sham-peck at each other, then subside about a foot apart and glare at each other for some minutes. It is mostly bluff and seldom comes to serious action. They coo at each other softly, like mourning doves. When the birds do fight, feathers fly. Amid an angry squawking and cackling, they strike and jump as fiercely as any game cocks. When it is over, neither is badly hurt, and the battlers resume their glaring crouch, or stalk off to dance again.

When sunrise begins to turn the gray world to washed-out brown, the activity of the birds reaches



➤ JUST talking it over but ready to fight. It is surprising to hear the birds coo at each other in this apparently threatening position


WISCONSIN
Original Location of Glacial Lake Wisconsin
DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
WASHBURN
SAWYER
BURNETT
PRICE
ONEIDA
FOREST
FLORENCE
POLK
BARRON
RUSK
MARINETTE
LINCOLN
LANGLADE
TAYLOR
OCONTO
CHIPPEWA
MARATHON
SHAWANO
CLARK
PIERCE
EAU CLAIRE
PEPIN
WOOD
PORTAGE
WAUPACA
BROWN
BUFFALO
TREMPEALEAU
JACKSON
OUTAGAMIE
WAUSHARA
WINNEBAGO
CALUMET
MANITOWOC
MONROE
LA CROSSE
MARQUETTE
GREEN LAKE
SHEBOYGAN
VERNON
CRAWFORD
GRANT
LA FAYETTE
GREEN
ROCK
WALWORTH
RACINE
KENOSHA

THE SECTION of Wisconsin occupied in prehistoric times by lacial Lake Wisconsin provided a home for the country's ost extraordinary populations of prairie chicken and sharp-iled grouse during the pioneer days of logging and farming

THE BLIND from which the author observed the mating dis-lay of the birds. They showed no fear of the structure and ould even boom and dance momentarily on top of it

◂ THE PATTERN OF DANCING FEET in the fresh snow of March. At the left end of the trail are two spots where the bird danced without moving forward

↙ A GROUP of dancing birds, photographed five miles west of Babcock, Wisconsin, in an area where sharp-tails have been known to congregate for 42 years

▾ ON DAMP OR MISTY MORNINGS, sharp-tails occasionally boom from the top of a small oak, where the sound seems to carry farther

a peak. This is the time for pictures. Or, perhaps, to make another vain search for the monitor that regulates the unison of their starting and stopping the dance. Often we have thought that it is the hen, who wandered about the dancing grounds, pecking indifferently but surely and gracefully at small black spiders and gnats crawling in the grass.

The casual behavior of the polygamous female on the dancing grounds is puzzling. It must be said that she demands a lot of wooing. She walks about leisurely. If pursued, she glides away. You feel sure that it is a pose, and that out of the corner of her eye she is casting amorous glances at some likely-looking fellow, — perhaps at an exuberant one, who, with an excited squawk, forsakes his dancing to jump and fly a few feet into the air, fluttering to the ground to begin dancing again vigorously. She may stop her wandering to draw up to full and motionless height, while a male comes near to give his most earnest performance.

I shall never forget one morning when a misty fog hung heavy over the grassy knoll. The birds were just visible, and because no hens were present, the show was sporadic. Out of the damp obscurity a lone hen alighted in the center of the ground in front of the blind. Immediately, a group of six cocks gathered about her. Each made for himself a little dancing ring in the larger circle about the silent and motionless female.

The noise rose to a jumbled din. Private dancing areas were forgotten. Tails were clicking and feet were pounding like the first rush of rain on dry oak leaves. There was a continuous excited booming that ceased abruptly as all performers posed rigidly with wings outspread; then, after a short pause, they began again, in unison.

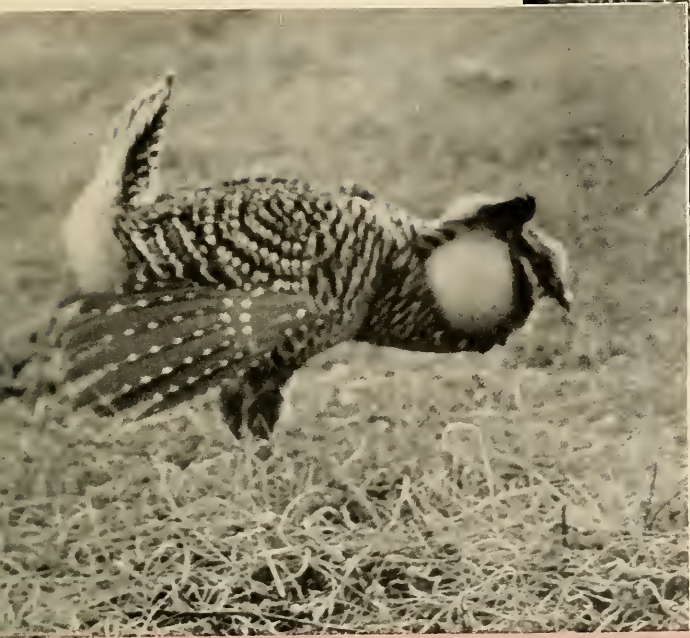
The hen moved off a few feet in a slithering glide, and the circle of grouse moved with her. When one moved too close, another rushed in to knock him down. Instead of fighting, they resumed their places in the circle.

The mist seemed to shut out the rest of the living world, leaving only this small mathematically perfect circle of eager sharp-tails, whose sense of fair play kept them all at an equal distance. There was a wild beauty that impressed me deeply, and their absorption made me think of predators that might lurk in the fog-hidden fringes of their grounds while they seemed oblivious to danger.

One morning a marsh hawk preened its feathers on a near-by haycock. The grouse apparently paid no attention. Presently the hawk flew up and made a circle over the dancers. Directly over two of the birds he swooped suddenly and struck at one. The intended victim ran a little to one side and escaped the open claws. The hawk swept on and resumed his preening and watching on the haycock. The pack was motionless for a time in puzzled, frozen silence. When they began again, the hawk remained—an ignored but dangerous audience.

Usually at a sign of danger there is a short *chirrup* that is almost

▲ AFTER HATCHING, the little sharp-tails and the hen leave the nest almost immediately



SOMETIMES a prairie chicken uses the sharp-tail's booming ground, and at rare intervals one sees a bird that shows mixed parentage like this one

simultaneous with the rushing beat of wings as the sharp-tails take off in several directions. If the morning is not too far spent, they will return again to the dancing ground.

Since this show is sexual in character, one might suppose that mating would take place at the traditional meeting spot. This is rarely the case. Some assume that it takes place when the birds leave the grounds in pairs. Such details are still largely unrecorded. In the last six years I have seen it but once each year.

Upon different occasions the sharp-tail and the prairie chicken have been seen using the same booming grounds. This is probably the beginning of the romance that produces the rare hybrid of these two birds that is sometimes brought down by the hunter.

When this ancient lake bed country was predominantly vast open sweeps, the prairie chicken was the most numerous bird, according to hunters. They by far outnumbered the sharp-tail, and the partridge or ruffed grouse was restricted to river bottoms and other wooded areas. In the last 30 years, however, a reversal of populations has taken place. The partridge is now the leading grouse. The prairie has all but disappeared, and the sharp-tail is following him. The causes are not far to seek.

First came a so-called agricultural drainage or ditching program that dried the marshes and changed the grass types. The second factor was the abandonment of farms, as a result of the drainage tax. Fires favored the sharp-tail, which therefore prospered briefly. Now young forests have come, and with them more ruffed grouse.

After the sun ceases to redden the morning, the vigor of the performance decreases and becomes desultory. The birds crouch and face their sparring partners more and more. Shortly after seven o'clock, depending upon the brightness of the day and the lateness of the season, the birds rise and sail away. Their flight is a characteristic three or four powerful strokes, followed by coasting on arched wings. And then they are gone, low over the leafless brush.

Stiffly we crawl out of the blind, our minds still full of images of the hearty fellows' booming, stomping, fighting, leaping, and bluffing, with purple boomsack expanding, tails upturned. Driving homeward to breakfast, Sid mentions how much the grotesque cavorting of these birds resembles the ceremonial dances of the Cree Indians, whose grouselike posturing and feathered decorations attracted the attention of Ernest Thompson Seton in 1890.

Then a grouse flies up from a willow thicket beside a road, and I remind Sid that in a week or two we should search for a nesting hen. Perhaps in the sweetfern of a sandy "island," beneath a bushy oak, or maybe in a patch of wiregrass or bluejoint.

The days of abundant sharp-tail are gone. For two years the hunting season has been closed for prairie grouse. They are at a low ebb in a recurrent 11-year cycle. Their dwindling numbers may again be reduced by the sportsman's shotgun. As we travel through the growing young forest, we realize that, although they may hold their own elsewhere westward from Lake Michigan across the northern part of the United States, here in Wisconsin we can think of them only as "the vanishing sharp-tail."

Gol

Is The Sunflower

By Charles B. Heiser, Jr.

Botany Department, University of California

e natural history of one of our largest flowers
the mystery of its origin, and the story of how,
der man's persistent cultivation, it has become
t only a favorite beauty but also increasingly
important as a source of food

IN parts of the Great Plains region of the United States, mile after mile of roadside in late summer is bordered by the golden crowns of sunflowers, and in many a garden throughout the country rows of tall plants with bright yellow heads may be found. Once again the sunflower is coming into its own in this country.

The exact circumstances under which man first domesticated the sunflower are not known, but we do not run into quite the same difficulties that are encountered in the history of corn, whose wild ancestors have not been identified. The sunflower in cultivation—frequently called the Russian Mammoth—differs greatly from its wild ancestors. Five to fifteen feet are common heights, and one sunflower has been reported with a height of 30 feet.

Photo by Packard from Black Star

▲ One of the biggest in the State: a sunflower cultivated in Maine. These yellow blossoms measured more than a foot across

◄ Close-up of a giant. The sunflower, a native American product, was cultivated by the Indians as a source of food even before the arrival of Columbus in America

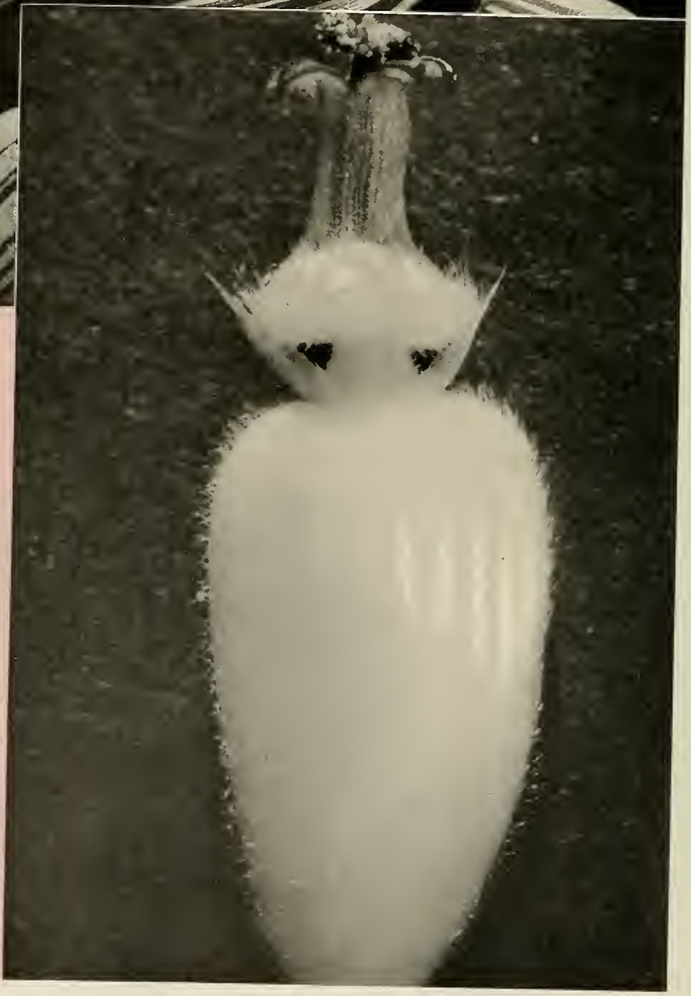
Photo by Eisenmeier from Free Lance Photographers Guild

Photo by Wolff and Tritschler from Black Star

➤ In the sixteenth century, the sunflower was exported to Europe, where it remained largely a curiosity until the Russians began to cultivate it in the early part of the nineteenth century. Today the Soviet Union is the world's greatest producer of sunflowers

Photo from Ewing Galloway

▲ Sunflower seeds of the Mammoth Russian striped-seeded variety. About 50% of the seed is protein, making it a valuable new foodstuff. In many European countries the seeds are eaten much as we eat peanuts



➤ As long as the sunflower seed is not ripe, it bears on its tip a blossom that gives it an outline like that of a short broad dagger

Photo by Dr. Croy from Black Star

These tall sunflowers generally bear only one head of flowers, which may be two feet wide. Even more important, the seed is about half an inch in length, whereas the seed from the wild plant is seldom even half that size.

In spite of these differences and others that can be noted in cultivated sunflowers around the world, they all came from wild "American stock."

In many sites of prehistoric Indians in Kentucky and the Ozarks, sunflower seeds and portions of sunflower heads have been found, and from seeds found in the latter place it would appear that the plants raised by the Ozark Bluff Dwellers before Columbus discovered America are little inferior to modern Russian plants. From the excrement found in the mounds and cliff dwellings of the Indians we know that they were using these seeds for food.

For almost as long as we have record the Hopi of Arizona have been growing the purple-seeded variety. What is very important to us is that the Hopi still grow these sunflowers, probably little changed from ancient times. The seeds are not only esteemed as food by the Hopi, but—more important to the Indians—they yield a purple dye that is very valuable in coloring their basketry. In addition to this, the sunflowers seem to have had a place in ceremonials. Many references are found indicating that the Indians wore the flowers in their hair during the various religious dances and festivals.

Before these facts were known, Peru or Mexico had been regarded as the place where the sunflower was first domesticated. One theory advanced was that the Peruvians, long before the Incas, developed the cultivated sunflower by feeding the plants with guano, the rich fertilizer found in certain areas of South America. Another theory was that the early inhabitants of Mexico brought the wild sunflower into cultivation by spacing the plants closely and thus causing them to produce one large head as we find in our cultivated sunflowers.

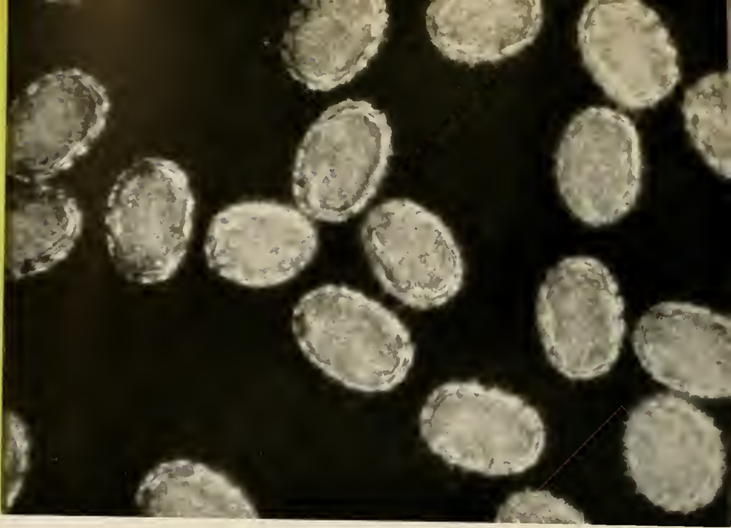
Today, with more facts at hand, it seems much more likely that temperate North America was the place of origin of the large-seeded variety. It has been argued that the prehistoric Indians of the Southwest developed the wild plant into the cultivated one, and that it was then carried eastward, tribe by tribe. However, it is quite possible that the cultivation may have started in the Mississippi region and then traveled to the Southwest.

Photo by Dr. Croy from Black Star

▲ BEFORE THEY ARE COMPLETELY MATURE: a picture showing the individual seeds as seen from above

▼ A CROSS SECTION through the sunflower reveals an unusual picture of the individual fruits lined up like tall, slender jars. They are still capped with little calyxes

Photo by Dr. Croy from Black Star



➤ SUNFLOWER POLLEN, highly magnified. Intensive experiments in breeding are being performed in the Soviet Union, Great Britain, and the Americas

Photos by Dr. Croy from Black Star

▼ THE FIRST SPROUT of a sunflower, greatly enlarged. Two leaves, still bonneted by the empty shell of the sunflower seed, have formed on a stalk rising from the soil

▼ THE BIGGEST DEMAND for sunflower seed in this country has been as an ingredient of poultry feed. The stalks are used as a fuel in Russia, the leaves as a tobacco substitute in Germany, and the fibers of the stem yield a substitute for silk

Photo by Wolff and Tritschler from Black Star

Exactly how these prehistoric Indians developed the large-seeded sunflower we can only surmise. Quite possibly when an exceedingly large sunflower suddenly occurred among the wild plants, the imaginative Indians credited the amazing phenomenon to the supernatural and from that time on cultivated the large sunflower. Or, they may have followed purely practical considerations in developing the flower in the direction of increased size.

Whatever may have been the origin of the cultivated plant, we find the early explorers of the West reporting that the wild sunflower was a very important plant to the Indians. Frequently the sunflowers were cultivated among the corn plants or, more often, just allowed to grow where they came up. The seeds of both wild and cultivated sunflowers were used for food.

Later, in the sixteenth century, the sunflower was taken from America to Europe, where it remained merely a curiosity for a number of years, until the Russians began to cultivate it in the early part of the 19th century. Its ride to prominence in that country is as fascinating as its early history.

The Holy Orthodox Church of Russia observed strict regulations governing diet during the 40 days of Lent and the 40 days preceding Christmas. Not only meat but many other fatty foods were on the restricted list. However, the oily sunflower seed, which was unknown at the time the rules were laid down, was not on the list. For this reason its rise to popularity in Russia was very rapid, as the seed easily supplied the lack of fats and oils in the people's diet without going against the letter of the law.

Today we still value the sunflower highly for its oil, which is comparable to the best vegetable oils. About 22 to 32 per cent of the seed is oil, and about 50 per cent is protein, which makes it an excellent food. This oil can be used as a salad dressing, for cooking, for canning fish, in paints, and as oil cake for stock feed.

The plant has many lesser uses. It has become an important fodder plant in regions where the growing season is too short for corn. The stalks have been used extensively as fuel in the Soviet Union, and many tons of high-grade fertilizer are extracted from the ashes yearly. The leaves have been used as a tobacco substitute in Germany. The fibers of the stem yield a substitute for silk, and a high-grade paper has been made from them.

In the Soviet Union and many other European countries, and to a lesser extent in this country, the seeds have been eaten much as we eat peanuts. The seed coat is broken off with the fingernails or teeth. The seed has a nutlike flavor that is very pleasant after one has become accustomed to it.

The "Russian Mammoth" striped-seeded variety is the most popular sunflower, but many other varieties are known, some with dark, others with white seeds. These seeds are planted and cultivated much like corn. In fact, in many respects the origin, history, and uses of the sunflower bear a strong resemblance to corn. There are some difficulties in harvesting the sunflower crop, but these can easily be solved with modifications of the implements used for corn. Sunflowers grow rapidly even in poor soil and are in most cases more resistant to drought and frost than corn is. According to recent tests they seem to be highly susceptible to certain insect and fungus diseases in this country, although this has not been true in Europe.

The Soviet Union is foremost among the world's producers of sunflowers, partly because of the exigencies arising out of religious customs, partly because of important work on the cultivation of new breeds done by Soviet scientists. Some of the Balkan countries also cultivate sunflowers widely. English scientists, particularly since the start of the war, have developed new varieties, and in the United States the outlook for sunflowers as a new crop also appears promising.

Argentina and Canada have been important producers of sunflowers in this hemisphere. In the United States, cultivation has been particularly strong in southeastern Missouri, Illinois, and portions of California. Ninety-five per cent of our production of seeds comes from these three states. Record crops were harvested in 1928-29, when about 16 million pounds of seed were produced each year. In spite of this, we have annually imported large amounts—over 37 million pounds in 1935. Our biggest demand for the seed in this country has been as an ingredient of poultry feeds, and many a farmer cultivates a row of sunflowers each year for his chickens. A United States Department of Agriculture publication in 1939 advised that it would be easy to overproduce sunflower seed, the market being limited; it now appears more likely that there would be a market for whatever sunflower seeds were raised. It is too early to predict the economic future of this "new" crop which dates back to prehistoric times. It is safe to say that it cannot compete with corn, but there should be need for both, particularly as a result of the new experiments on sunflowers that are being carried on in widely separated parts of the world.

In addition to its economic uses, we find the sunflower valued for its beauty alone. It is the State Flower of Kansas; and towns and at least one county in the South are named after it. Many beautiful and different sunflowers are listed in the seed catalogues today, forms that have all come from the wild type of the Great Plains. The history of one of these is worth retelling.

Professor T. D. A. Cockerell of the University of Colorado and his wife had seen millions of sunflowers during their life, so it was not without surprise that they blinked at what met their eyes in the summer of 1910. Near their house by the roadside where sunflowers grew wild, Mrs. Cockerell saw what she thought was a red butterfly on one of the plants. She stood watching it, fascinated, expecting it to fly away. When it did not, she investigated and found that it was not a red butterfly but a single red sunflower growing among dozens of yellow ones, something quite new for horticulture.

The Cockerells could not leave the plant where it was near the road, so they carefully dug it up and transplanted it to their garden. Not only was this discovery of interest to science, but the variety would prove valuable to flower fanciers if they could succeed in growing and obtaining seeds from it. Here, however, difficulties presented themselves. Dr. Cockerell knew that sunflowers were cross-pollinated and that he would have to cross the red sunflower with a yellow one to get it to set seed. Fortunately, Dr. Cockerell knew the principles of genetics and botany. The first seeds from this wonderful mutant were sold to Sutton & Son of Reading, England. Today we have not only red sunflowers but wine-colored and streaked red and gold ones, all due to the patience and foresight of Dr. and Mrs. Cockerell.

When she was in Russia in 1932, Mrs. Cockerell saw some of the red sunflowers growing in a public park near the Black Sea. Naturally she was interested in knowing where they had obtained her red sunflower. The director of the park seemed surprised. "This is the red sunflower of the Red Army," he informed her.

Although most people appreciate the beauty of the flower, they do not generally realize how complicated the make-up of the flower is. For one thing, what is commonly thought of as the flower is in reality a number of flowers gathered into a head. The outer petals are all individual blossoms and serve as landing fields for insects that come to the plant for nectar. The inner flowers making up the yellow or purple disk are then pollinated by the bees or other insects walking over them in their attempts to get the nectar or pollen. Thus Nature has provided a very efficient means of pollinating several flowers with the effort that would ordinarily be involved in pollinating only one. Daisies, chrysanthemums, dahlias, and asters are only a few of the many plants with the same "composite" flower structure. One sunflower, the huge double variety, looks very much like a chrysanthemum to one who is not familiar with both plants.

There are many other kinds of sunflowers besides the common one. About 100 different species are recognized by the botanist, most of which are perennial. The common annual one we have been discussing was named *Helianthus annuus* by Linnaeus. *Helianthus* literally means sunflower, from the Greek "helios," meaning sun, and "anthos," meaning flower. As to whether the sunflower actually follows the sun, there is still some debate. Scientific tests have shown that at least in certain stages, the sunflower does follow the sun, the head turning to the east in the morning and to the west in the afternoon.

The 99 or so other sunflowers are mostly of little economic importance, except perhaps as weeds and in a few cases for ornamental purposes. There is one exception, the Jerusalem artichoke, which is not from Jerusalem nor is it an artichoke. This plant produces an edible tuber resembling the potato and is grown in many countries for that reason. The Soviet Union has been one of the foremost countries to experiment with and develop this plant, but again the American Indian was the first to recognize it. This sunflower, like all the others, originally came from the western hemisphere, and there is evidence that the Indians were using it for food long before the coming of the white man.

So it seems that sunflowers, along with quinine bark, rubber, corn, potatoes, beans, and many other plants, were the wealth that the Americas gave to Europe, rather than the gold for which the early explorers searched.

Perhaps we can now well agree with Algernon Swinburne when he wrote:

A kingly flower of knights, a sunflower,
That shone against the sunlight like the sun.

▼ The sunflower is valued for its beauty as well as its economic uses. It is the State Flower of Kansas and has had at least two towns in the South named after it

Photo from Ewing Galloway

MEXICO
MEXICAN TOURIST ASSOCIATION
ASOCIACION MEXICANA DE TURISM

TULA—City of Buried Gods

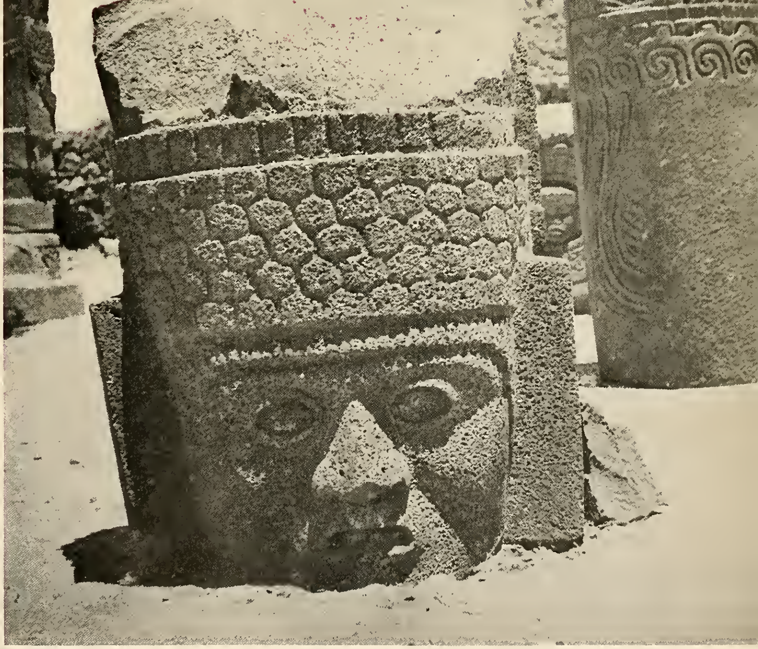
Visitors to Mexico can now see the fabulous capital of the Toltecs—the cultural center of a legendary people recently brought to light by scientific excavating

Photographs by the author

By Dorothy Reynolds

ABOUT 50 miles north of Mexico City, on the high central plateau, lie the remains of a mysterious city—a city once so mighty that its fame spread beyond the edge of civilization, even among the barbarous tribes living in the far corners of Middle America. So splendid was it that its memory lingered on for many centuries after the actual settlement had been abandoned. Its name became a symbol of grandeur and magnificence, fraught with magic power to set men's hearts afire.

Tula! The Mayan rulers of northern Yucatán claimed it as a homeland, and the inhabitants of other now long-dead cities in the depths



➤ The uppermost section of a warrior column, which helped to support the roof of the Moon Temple. The great cylinder to the right is a section of a feathered serpent column of the jungle traced their origin to it. The exact time and place of its existence were forgotten, but legends of it became mingled with those of gods and heroes, taking on a supernatural quality.

It is not difficult to visit this mysterious dream city, for it is located a mere two-hours' train ride from the Capital. The modern Tula, at which you alight, is a rambling, nondescript little town, not essentially different from any other small Mexican *pueblo*. In order to reach the Tula of the past, you must turn to the east, follow a dusty road across a swaying suspension bridge hung frighteningly between high cliffs, and clamber up a steep path edged with rock walls and gigantic cactus plants until you come to a gently rolling plateau.

There lie the remains of the city which, some ten centuries ago, was the capital of the mysterious Toltecs, a people once considered as mythical as the centaur or the unicorn, but whose existence and importance now seem proved beyond a doubt. Yet, although much has been brought to light by modern excavations, a great deal about the Toltec civilization is still unknown or puzzling and very likely will always remain so.

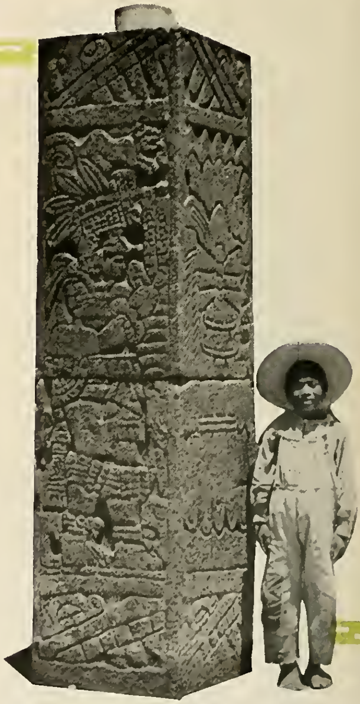
Just when the Toltecs reached this locality is one of the many secrets that surround these mysterious people. They probably came from the northwest and conquered a group of more primitive inhabitants somewhere around the year 1000. According to the *Anales de Cuauhtitlán*, they founded the city in 873, and left in 1064, but other manuscripts place the date of their arrival somewhat later.

Eventually, however, they in turn were forced out by a new invasion, that of the warlike and barbarous Aztecs, who compelled the Toltecs to leave the fine capital city which they had built for themselves with so much skill and such unsparing labor. Thereupon, the bulk of the population moved to Cholula (called by them Tullam Chollullam), and this became their new capital.

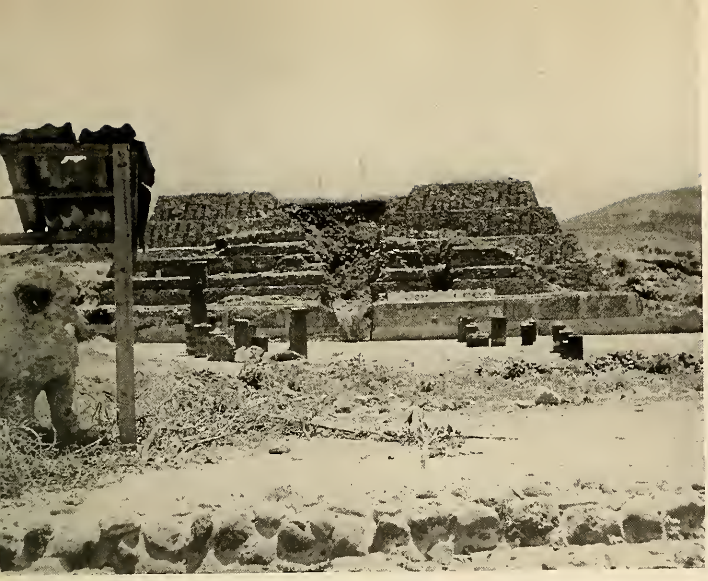
▲ FIFTY MILES from Mexico City you cross this swaying suspension bridge and surmount the plateau beyond to see the majestic ruins of Tula, the recently unearthed capital of the mighty Toltecs

The Toltecs were a comparatively peaceful and cultured people, governed by priest-kings representing their god Quetzalcoatl, some of whom bore his name, to the confusion of later historians. According to one chronicle, the god himself founded the city of Tula and became the first ruler. Also according to the legend, it was he who made the laws and introduced the arts of weaving, jewelry making, and stone carving. The last king, in whose reign occurred the fall of Tula, was called Topiltzin Quetzalcoatl.

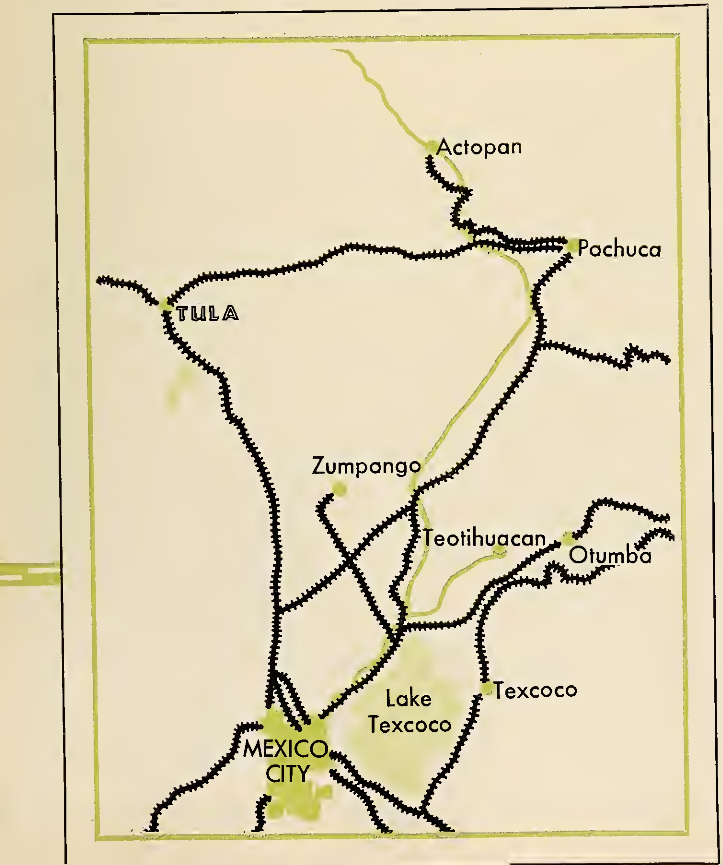
The civilization of the Toltecs radiated very widely, for various colonies were established during the time of Tula's ascendancy. According to the books of Chilam Balam, even Yucatán was invaded by them, a fact which seems proved by the typically Toltec architectural and sculptural innovations—such as serpent columns, tiger friezes, caryatids, and butterfly chest ornaments—made in Chichen Itzá during the so-called Mexican Period.



▲ HALF OF ONE of the square columns that formerly supported the roof of the temple atop the Moon Pyramid. The carving depicts a warrior in ceremonial costume. The tenon on top served to hold the next section in place



▲ Only a few years ago Tula's spectacular Moon Pyramid was but a grass-covered mound. The V-shaped cut reaching into the center of the pyramid has been cleared out by modern archaeologists, but it was originally made by the Aztec conquerers of the city when destroying one of the most magnificent temples in all Mexico, which stood on top. The stone tiger (*foreground*) overlooks one of the ball courts



The mixture of pottery types in certain layers of the excavations at Tula seems to prove that even after its conquest, some of the original inhabitants still remained there, living among the invaders. Many also took up their abode in the comparatively near-by towns of Colhuacán, Cholula, Uexotzinco, and Tlaxcala, but the greater number spread out in all directions, some even going as far as Tabasco and Central America. Thus were justified the frequent references to Tula as a homeland in the legends and chronicles of various scattered tribes.

Not only did many daughter cities of the same name spring from the original settlement, but the memory of the metropolis itself took on a more and more legendary and supernatural character with the passing of time.

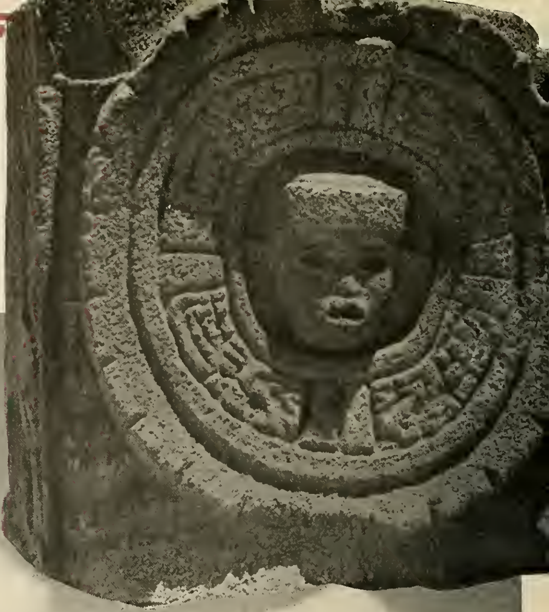
"Our fathers and ancestors came from Tulam," wrote the Cakchiquels of the highlands of Guatemala. "At the sunrise is one Tulam, and one is at Xibalbay, and one is at the sunset—and one is where is God—from the sunset we came, from Tulam, from beyond the sea."

The near-by Quichés likewise claimed to have come from a Tulam, one situated in the east—the place where their leaders received their wisdom, where the gods they worshiped were first known, and where they established the tradition of offering incense to the sun upon the breaking of the dawn.

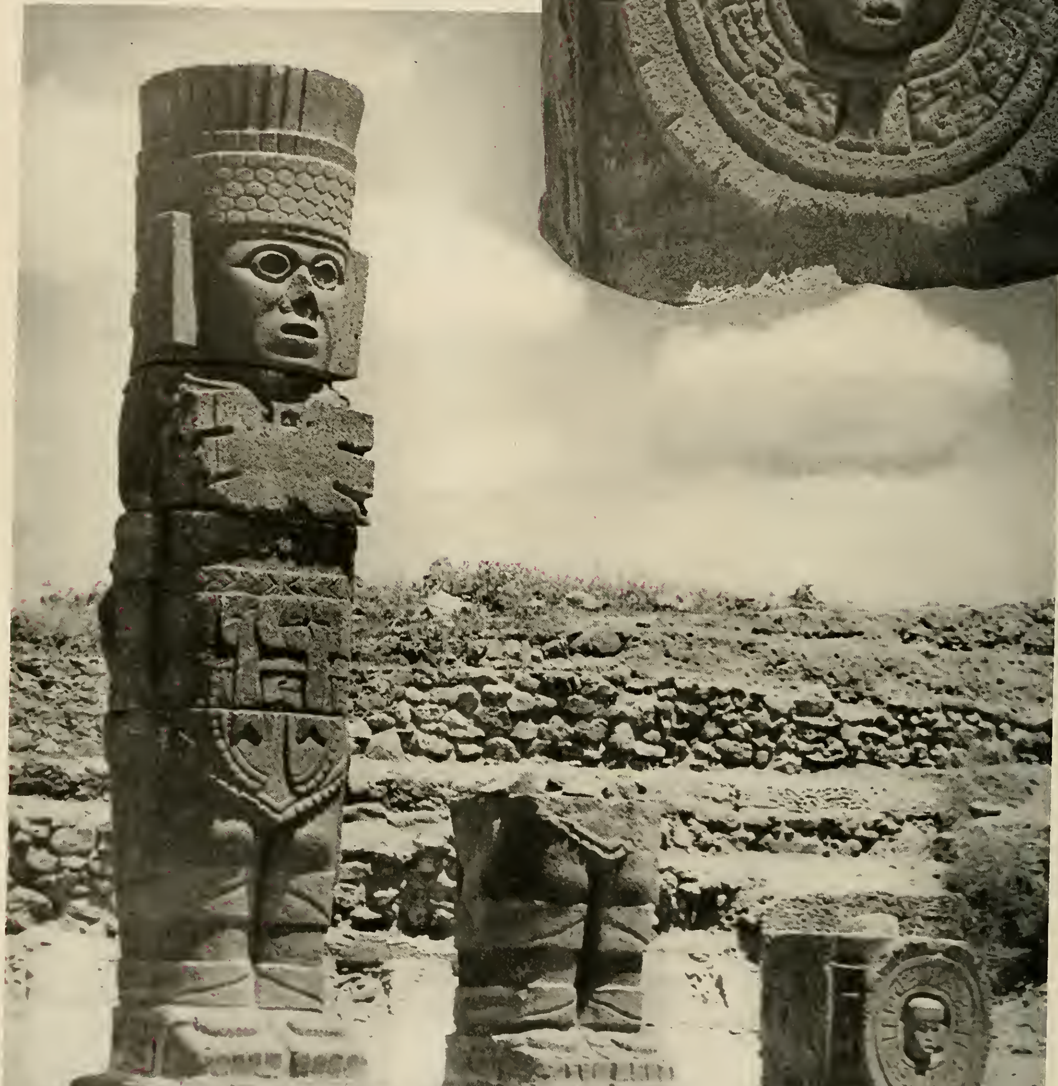
Most of our information about Tula has been obtained from Aztec sources. When the invaders first reached the region occupied by the Toltecs, they found there what seemed to them a marvelous civilization with great and magnificent cities, such as they had never dreamed existed anywhere.

As is natural when an inferior culture displaces a superior one, they exaggerated the actual skills and abilities of the Toltecs, which became still further magnified in repeated telling and took on legendary proportions with the passing years. The people of Tula were reputed to be supermen, possessed of such great quantities of gold

➤ **This circular belt buckle** from the back of one of the great warrior figures is about three feet in diameter. Such a disc with a human head in the center probably represents the sun



⮟ **At least four** of these heroic figures, each 15 feet high, were among the supports of the Moon Temple. Two unassembled sections of a similar figure are shown beside it. The butterfly chest ornament is characteristic of Toltec art



and silver that their very palaces were composed of it. They were marvelous lapidaries, skilled in the smelting of silver and the cutting of precious gems, especially the green, jadelike stone known as *chalchihuitl*. It was said that they had peculiar powers of discovering mineral deposits by standing on a hilltop just as the sun was rising and noting any small clouds of vapor that emanated from the ground.

The Toltec period was looked back upon as a golden age. In those days, people said, the ears of corn were so large that they had to be carried in the arms like cordwood; squash were a fathom in circumference, and stalks of the wild amaranth were so tall and strong that they could be climbed like trees. Forests teemed with game and many-colored birds, and food was so abundant that nobody ever thought of eating the small ears of corn, but burned them for firewood.

Cotton in the fields was of all colors—red, yellow, purple, green, blue, gray, brown, and orange—so that beautiful fabrics could be woven without dyeing the yarn. The walls of houses were covered, some with *chalchihuitl*, others with silver, red and white shells, turquoise, and rich feathers.

Gods lived in the mountains in those days, and the Toltecs themselves were regarded as more or less supernatural beings—marvelous magicians, highly skilled in sorcery and divination. As to their god Quetzalcoatl, originally the divinity of knowledge, the Aztecs took him over, and—since all knowledge seemed to them somewhat magical—made him the god of sorcery. Eventually he was even made the patron of thieves, and an image of him was carried when a person went to rob a house, in the belief that it could cast a spell on the inhabitants and cause them to fall into a deep sleep.

So firmly convinced were the Aztecs of the superiority of the people they had conquered that they were eager to intermarry with them, and those families which could boast of Toltec blood enjoyed considerable social prestige. Even the Aztec kings frequently chose Toltec women as brides; indeed, the first ruler to ascend the throne after they reached the Valley of Mexico was the son of a Toltec princess.

For centuries after the Spanish Conquest, the previous existence of Tula was accepted as a matter of fact. Early European historians in the New World credulously copied down everything they learned about it from Indian legends and chronicles. Much of what they recorded was so obviously fantastic that later, more critical-minded scholars began to doubt it all, and some even relegated the Toltecs to the status of mere legendary figures.

The ruins at Tula were left almost unnoticed for a long time. They were smaller and apparently less spectacular than many others; and even those archaeologists who admitted the probable former existence of the Toltecs assumed that their capital had not been at Tula but at the evidently much more important site known as Teotihuacán, and that the names of the two places had somehow become interchanged.

Consequently, it was not until 1940 that serious archaeological exploration was finally begun. But the discoveries made in this and subsequent years were so revealing that even the least credulous were forced to admit that this had, indeed, been the capital of the mighty Toltecs. Excavations are still going on at the present time, and although a large proportion of the ruins still remain covered with the dust of centuries, much has already been learned about the life, culture, and historical importance of this ancient metropolis.

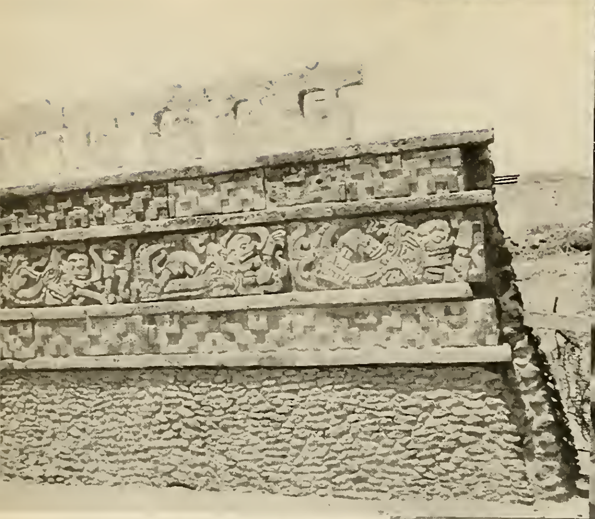
The Toltecs built well, so well, indeed, that their sculpture and masonry astonished their less skillful neighbors. Like most of the early inhabitants of America, they chose a dramatic site for their capital—a sun-drenched hilltop overlooking a fertile green valley. They planned the city carefully, with pyramids and temples, ball courts, and dwelling places for the priests and rulers, all made of stone blocks, carefully hewed to shape and firmly fitted together, and beautified with many carvings and much magnificent statuary.

As in most of the early centers of population in Middle America, these principal structures seem to have been grouped together to form a focus of public life, a gathering place for civic and religious ceremonials and festivals, sports and spectacles. The main edifices were once surrounded by the less substantial homes of the common people, which were built of wood or adobe and have now completely disappeared.

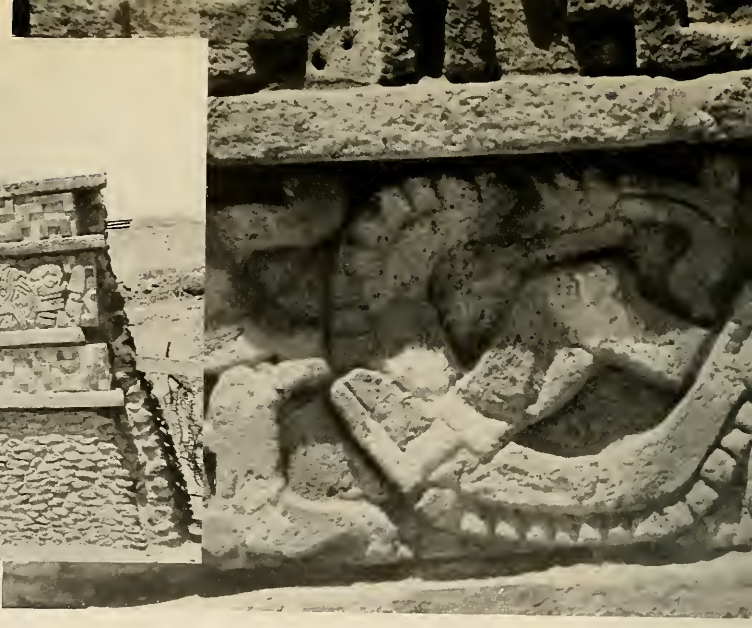
Today the structure of most interest at Tula is the so-called Monticulo de la Luna, or Moon Pyramid. Much of its original form can be seen because of the complete excavations of the Mexican Government archaeologists, and it is hard to believe that several years ago it was only a grass-covered mound like another unexcavated but larger pyramid near by.

The Moon Pyramid is built in the tiered formation so frequently seen in Mexico. Like all other Mexican pyramids, it also has a flat area on top, but only a fragment remains of the broad stairway that once led up to it on one side. Nothing remains in place of the temple that formerly surmounted the pyramid, but we know that it was one of the most magnificent temples of all Mexico. This we know because many fragments of the giant columns and pillars that supported its roof were found inside the pyramid and along one of its sides.

Tula did not decay and fall naturally into ruin. It was a city conquered and sacked by the invading Aztecs, who not only took away the small and easily carried objects, but systematically stripped the buildings of most of their facing stones and sculptures. It is indeed fortunate that portions of the Moon temple were so large and heavy that they could not conveniently be broken up and carried off. The Aztecs tried but did



▲ ENCLOSING THE MOON PYRAMID on the north is a high wall beautifully carved in low relief. The surfaces are decorated by a frieze of serpent figures devouring dead human beings



▲ A SERPENT devouring a skull is featured in this wall decoration

not entirely succeed. They cut a great ramplike trench into the body of the pyramid, tumbled the heavy sculptures into it, and left them there. They succeeded in dragging others away, but enough remain for us to partially reconstruct, in our mind's eye at least, the proportions and style of the temple.

The great sculptures from the temple, which have now been gathered together to the north of the pyramid, merit special attention. They form a number of great columns, each in four sections and held in place by skillfully made tenons fitting into holes in the sections above. All columns were fifteen feet high, and they supported the roof of a temple that could hardly be rivaled in its barbaric splendor.

There were at least four square pillars with relief carvings on their sides depicting warriors in ceremonial costumes, who carried a curved sword and darts in one hand and an atlatl or throwing stick in the other. Alternating with these warrior figures were patterns representing bundles of arrows.

Even more striking than the square columns are the colossal caryatids in the form of richly dressed warrior figures, each again made up of four sections tenoned together. Weapons are held in the hands and there is an ornament in the form of a stylized butterfly on the chest. The belt bears a large disc-shaped ornament at the back, in the center of which is a human head.

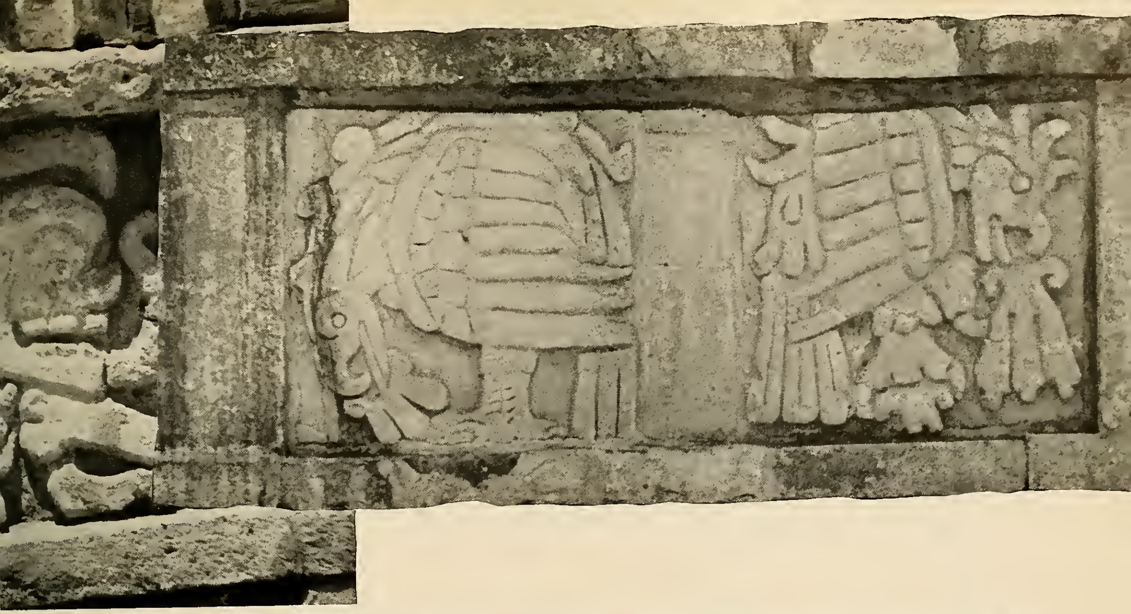
There are also sections from several round columns that can be identified as having represented a gigantic plumed serpent. Although none are complete, these columns were undoubtedly of the same form as the well-known serpent columns at Chichen Itzá in Yucatán, with the mouth of the serpent extending outward from the base and with its tail directed upwards to form the support of the lintel over the doorway of the temple.

It is true that we can only imagine how these colossal supports were grouped to sustain the lofty and undoubtedly elaborately decorated roof, but it must have been a truly awe-inspiring room.

Various smaller sculptures have also been found, and a particularly fine series of relief carvings exists on the lowest tier of the pyramid's eastern face. These latter consist of a frieze of walking tigers and a number of panels of eagles and vultures eating human hearts. There are also several panels representing a human head held in the mouth of a plumed serpent, probably representing the god, Quetzalcoatl. Located on this same side of the pyramid are the foundations of a number of rooms surrounding a small courtyard, probably used by the priests in charge of the temple ceremonies.

Enclosing the pyramid on the north side is a high wall beautifully decorated on both sides with carvings in low relief and with a scroll-like ornamental crest. The principal frieze consists of a series of undulating serpents devouring dead human beings, represented by skulls in the serpents' mouths. It is supposed that this motif symbolizes the planet Venus, one of the attributes of Quetzalcoatl, the chief god of the Toltecs.

West of the pyramid, there is a ball court, and to the north is a



▲ FIGURES nearly identical to others on buildings at Chichen Itzá, over 500 miles away in Yucatan: a portion of a frieze on the east side of the Moon Pyramid

second, a smaller one, the latter in the best state of preservation. After the Aztecs conquered the city, they removed most of the stone from its walls for their own use, but the floor plan, in the form of a double "T" sunk in the solid rock, is still well preserved. From the form of the court, it seems to have been used for the game later known as *tlachtli,* or some very similar one.

Tlachtli was a very widespread diversion, combining certain features of basketball, handball, and soccer. The ball had to be struck with the knees, hips, or chest, and points were made either by causing the opponents to miss on the attempt to return it or by performing the extremely difficult feat of sending the ball through the opening in a stone ring placed perpendicular to the wall at a height of eight or ten feet. It was a very lively game, and—in Yucatán, at least—was made additionally exciting by the custom of allowing the winners to strip the losers of their jewels, ornaments, and even their clothing, if they could be caught before they were able to escape from the court.

In the period of Tula's greatness, the ball courts were evidently well adorned with sculpture. On a platform erected at the south side of the smaller one stands a tiger with a knotted cord around its neck (a typically Toltec symbol) and a hole for a standard in its back. Near by, were discovered a standard-bearer in the form of a human figure, and a beautifully carved image of a ball player brandishing a club and wearing a great headdress of quetzal and eagle feathers, a nose-bar, gloves, and knee protectors.

These finds already uncovered at Tula have been sufficient to verify not only the existence of the Toltecs, but also to justify their legendary fame as skilled sculptors and builders. Yet, the excavating is far from finished, indeed, the greater portion of the architectural constructions are still covered with the accumulated dust of ages.

Within these grassy mounds may be the remains of temples such as those mentioned by Shagun, who wrote that one group was composed of four buildings, the eastern ornamented with gold, the northern with red jasper and red shells, the western with turquoise, and the southern with silver and white shells. He described still another temple as decorated inside entirely with feathers, the walls being covered respectively with yellow, red, blue, and white—the colors of the four world directions.

There is much about this fascinating and mysterious metropolis that we shall never know, for no Toltec manuscripts exist today, and the only vestiges of the written language of Tula's ancient inhabitants are a few glyphs, nearly all of unknown meaning, which seem to resemble those of the Zapotecs.

Most of the statues and columns that have been unearthed are not yet reassembled. Like figures out of some Indian version of the Judgment Day, the sections lie scattered about on that high, sunlit plateau, waiting to be put together again. Only then will they take on once more something of the appearance they must have had in the time of the greatness of Tula, once the splendid metropolis of the Toltecs, now only a mysterious dream city of the past.

REACHING FOR THE MOON

Our fastest planes would take less time to reach the moon than it took our grandparents to cross the Atlantic. Will atomic propulsion permit you to leave the earth one day and be on the moon the next? Or would you rather watch the first lunar exploration through your "electron telescope?"

By Edwin D. Neff

ALTHOUGH the astronomers haven't reported it, the moon is closer to the earth today.

Rocket ships, radio directed, are real. Atomic power is terribly real. Radio waves, as proven by the Army's radar contact with the moon, can penetrate the ionosphere, that region of awful mystery beyond the earth's stratosphere. Can we not imagine space ships, powered by the atom, guided by radio waves, carrying men to the moon?

So far, post-Nagasaki discussion of peaceable uses for atomic power has been concerned with earthly tasks: moving trains, supplying industrial energy, and the like. But the one big fact about atomic energy so far seems to have occurred to only a few. If atomic energy can be harnessed as a propellant, it is the first energy discovered by man great enough to lift him and his machines off this planet and send him hurtling through outer space for sustained flight.

Lack of power and means of accurate navigation have previously been the two main causes of failure in space flight of rockets. Today scientists whose names spell authority see in atomic power the means to conquer space. Henry Norris Russell of Princeton, for example, has asked George Gamow, the distinguished theoretical physicist, to plead in the latter's forthcoming book that uranium be saved for interstellar flight, rather than be wasted for earthly tasks before we know what atomic power is all about.

Atomic power may offer man his first real chance to burst the earth chains and soar to another celestial body.

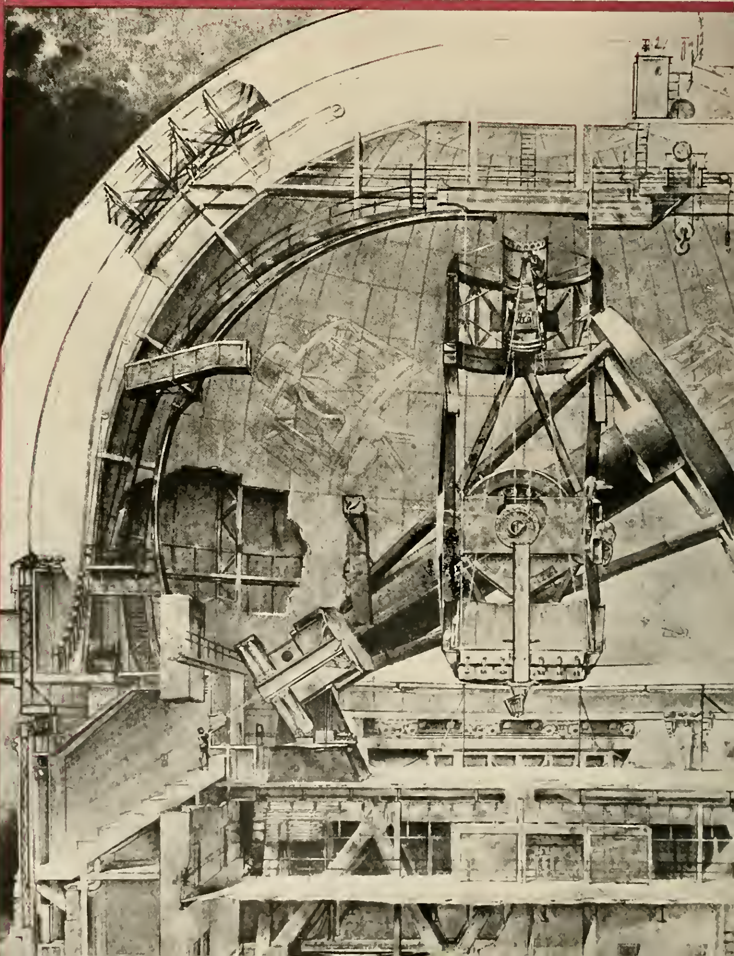
Already one astronomer, a professor at Ohio University, supposing the moon will be man's first target, is wondering whether a method cannot be devised for plumbing whatever supply of uranium that satellite may have. As everyone knows, uranium is a metal with a price on its head down here.

Of course, no one can measure the amount of uranium on the moon. The usual spectrum analyses are useless, for moonlight is but reflected sunlight. The possibility of uranium there must be postulated on the theory that the moon was spun from the earth's crust, and in the earth's crust is its uranium supply. This theory of the moon's origin belongs to Sir George H. Darwin, son of the evolutionist.

He believed that a few billion

▼ **The giant eye of Palomar:** An imaginative drawing by Russell W. Porter showing the 200-inch telescope. At its largest practical magnification it will bring the moon within an apparent distance of about 24 miles from the earth

From The Glass Giant of Palamar *by David Woodbury (Dodd, Mead and Co.) original drawing property of California Institute of Technology*



▲ CRATERS ON THE MOON as they would appear if photographed with an ordinary camera from a distance of approximately 1000 miles. The photograph was taken at reasonable magnification with the great 100-inch Hooker Telescope at Mount Wilson Observatory.

years ago the moon was flung into space from the earth – that it had been a part of the earth occupying the space now covered by the Pacific Ocean. The earth's much more rapid rotation then, plus the disturbances of the solar tides, were responsible for the birth of the moon, according to this theory. It has not been proved, but after a good bit of debate it still remains a possible explanation.

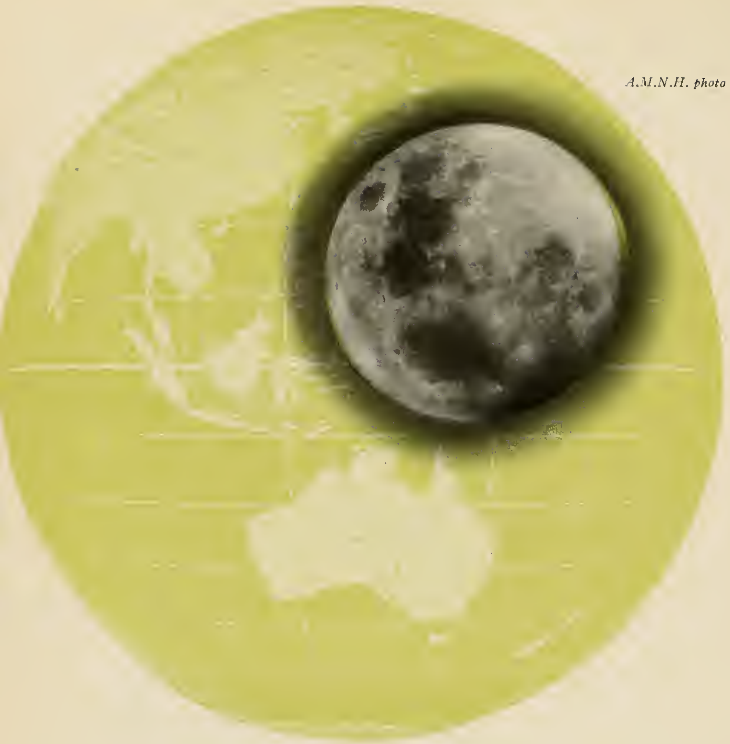
The adventurous spirit of man can find in the prospect of moonflight, romance enough to stop his breath. A poet wrote:

> Reason has moons,
> But moons not hers are mirrored in
> her sea.
> Confounding the astronomers,
> But oh, delighting me!

In this spirit let's try to imagine what visiting the moon would be like. Astronomers already know enough to make what follows fiction only in the sense that it has not actually taken place.

Your trip would be in a sealed, air-conditioned space ship, and your hangar on the moon, carried with you, would be a sealed, air-conditioned, pre-fabricated "quonset" type. Both ship and hangar would of course be pressurized to compensate for lack of atmosphere up there, and you would have to wear a pressurized diver's suit, electrically heated for night wear.

Once beyond earth, your pilot would have to be on the lookout for runaway meteors, those gor-



A.M.N.H. photo

THE MOON is 2160 miles in diameter and if cut in half would cover a relatively small part of the Pacific Ocean, from which, according to one theory, it is supposed to have originated

geous celestial junk wagons, because collision with a pebble-size meteor might leave no survivors. But there is less chance of this than a trainwreck on earth. Your trip would be warm with sunlight, and atomic power would get you to the moon in a few days, perhaps hours. Your pressurized ship will prevent your "exploding" once you are beyond earth's atmosphere. And once beyond that atmosphere, the blue sky of earth changes to black.

When you glide into a lunar valley and your ship is slowed by power-brakes to a gentle landing, you will be in fairyland.

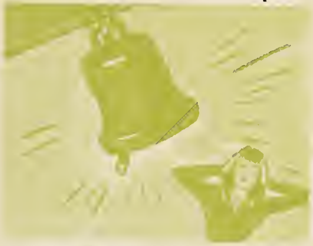
It is a land of sharp and bitter contrasts, with magnificent lunar mountains rising to 25,000 feet in height, interspersed with vast craters, perhaps volcanic, perhaps caused by the impact of meteors dropped like marbles into thick mud, and great lunar plains, believed by ancient astronomers to be oceans of water. But these we find dry, as astronomers on earth already know. There is no water, or only a trace, on the moon. It is a dead world; frightening, fascinating.

Behold the lunar sky. If you arrived during the lunar day (which lasts two weeks) you would yet find

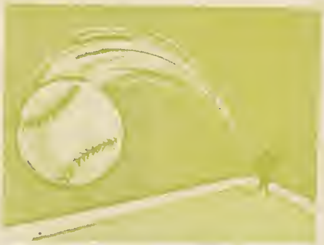
THE EARTH as seen from the moon. Many are surprised to know that the earth's clouds would probably prevent the continental outlines from being any more distinct than shown in this painting. The airless lunar landscape is characterized by harsh contrasts between sunlight and shade

An oil painting by Howard Russell Butler. Photo by H. S. Rice

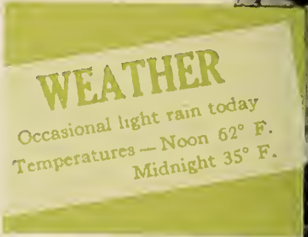
Drawings by Museum Illustrators Corps



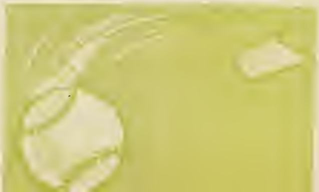
SOUNDS would be inaudible on the moon, because there is no atmosphere to carry them to the ear

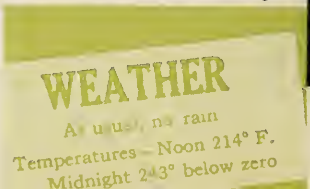


WITH GRAVITY one-sixth as strong on the moon, a cleanly hit baseball might travel 3000 feet


WEATHER
Occasional light rain today
Temperatures — Noon 62° F.
Midnight 35° F.

A DAY on the earth compared with one on the moon, where the weather never changes

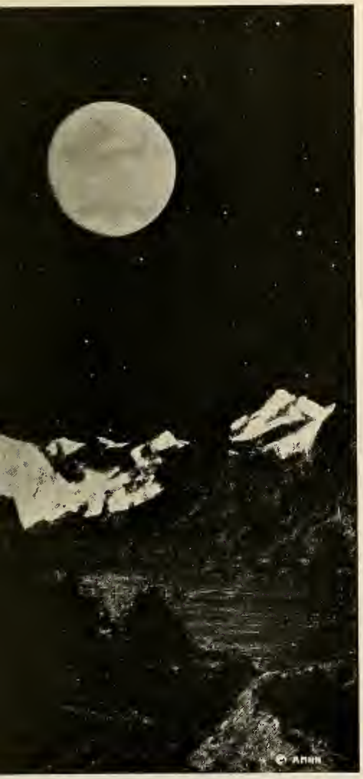




the sky black; sun and stars are seen simultaneously. A great many more stars are visible to us here than on earth, for there is no atmosphere to hide their fires. The stars seen from here never twinkle, because there are no shifting currents of air of different density to cause the refraction effect. Their light is brighter than our stars and steady as an electric bulb. Black sky, bright stars, bright sun.

If you arrive at night—during the dark of the moon—, you will probably circle the satellite to its farther side, disappearing from the sight of astronomers who, with improved telescopes, may be following the speck that is your space ship. Then you will look down upon a land that the eyes of man have never before beheld — the opposite face of the moon.

There is no cooling cloak of air to shield the moon from the terrible heat of the sun, and it may be 214 degrees Fahrenheit during the lunar noonday, but a frigid 243 degrees below zero at midnight. And what shadows! Without atmosphere, there is no diffusion of light. that is why the sky is black; why the earth's sky is blue. Let's look at a moon mountain in the raking light of afternoon. Its crests are bright, its valleys India ink.



You see only what is directly hit by light. No sepia effects, no shadings. Something like a photographic negative. And as long as the moon day lasts there will be clear sunlight. No rain, nor fog, nor mist, nor snow, nor sleet, nor hail. No changes of weather. The temperature changes are always predictable.

No sound either, or odors. No atmosphere to carry them. A silent world. A dead world. If we are to speak to our fellow passengers and be heard, we must use hearing aids like those used by the deaf, carrying sound vibrations direct to the ear bones. A world of contrasts. Light and dark. Cold and heat, but always silence. And there are no lovely sunsets here as on earth, for the sunset colors are atmosphere-produced. Night comes suddenly on the moon, and like the day, lasts two weeks.

Here is another surprise. If we are equipped to leave our pressurized cabin and move about, we seem young again. Our movements are almost effortless. We can jump six times as high on the moon with our earth-trained muscles, for the pull of gravity is just one-sixth that of the earth. A baseball diamond might have to be six times as large as on earth, and a home run would mean a sprint of better than a quarter of a mile. The ball itself, cleanly hit, might travel 3000 feet. Imagine the records set during a track and field meet on the moon!

But now the loveliest sight of all —mother earth hanging in the lunar sky. If we are on the side of the moon facing the earth (41 per cent is invisible from the earth), our planet will remain fixed in the sky, lit by the sunlight. We are used to thinking of the crescent moon; now we must think of the crescent earth, for it passes through the same cycle of phases as the moon does when seen from the earth. But how much bigger and brighter it is. If we see a "full earth" during the lunar night, it appears about 13.4 times as large as our full moon, and since the earth has about six times the reflecting power of the moon, the full "earthlight" will be about 80 times as bright to us on the moon.

Because of the earth's atmosphere, we see the outlines of continents dimly, but Africa, for instance, might be recognizable. And perhaps the observatory on the Cape of Good Hope is peering at us; we are homesick, and descend to earth, avoiding the Dark Continent for LaGuardia Field.

Perhaps no one can say when all this will take place. But a somewhat piquant light is shed on the long way we have come toward that day by the quaint suggestions of earlier reachers for the moon. One John Wilkins, writing in the seventeenth century, thought men might get there on the backs of giant birds, but also suggested that a machine might do the trick. Francis Godwin, another seventeenth-century writer, thought the bird idea so silly he made his hero, Gonzales, experiment with wild swans until he discovered that exactly 25 would be needed to bear the weight of a man. Gonzales, swan-borne reached the moon in 11 days!

Old John Wilkins' idea of visiting the moon prompted other contemporaries to consider hot-air balloons, giant slingshots to catapault men over the 238,857-mile stretch, and even large bottles of morning dew!

But if nature conspires to keep man on earth for another generation or two, there is still a certainty that you will get the most intimate possible view of the moon short of an actual visit. The new 200-inch reflector being completed for the observatory at Mt. Palomar, near San Diego, California, will bring the moon to within 24 miles of the earth at its largest practical magnification. It will be about the same as viewing the Chalk Cliffs of Dover across the English Channel from Calais.

THE FIRST IN A SERIES ON THE
FLOWERS OF THE FOUR SEASONS

The PEONY

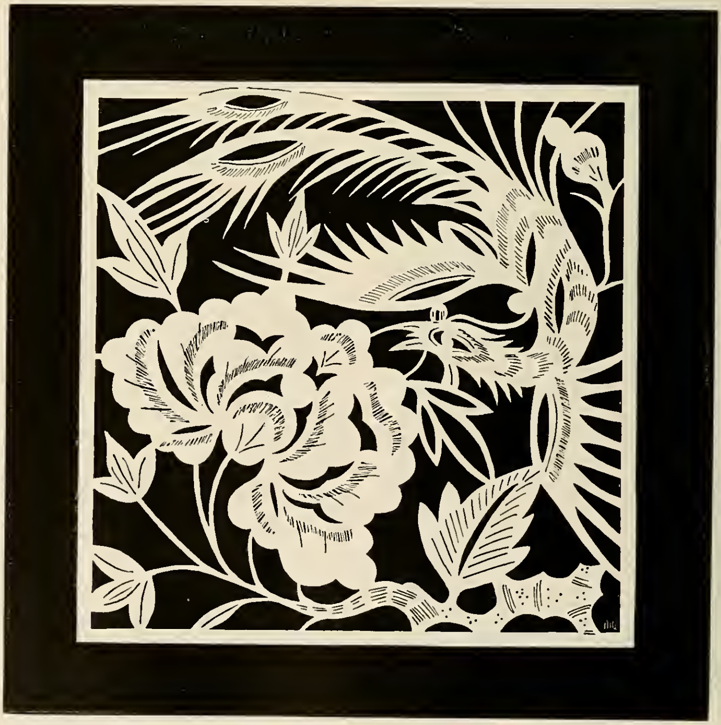
▼ "Everybody says, 'It is the Peony Season.'
And together we follow the crowd
To buy flowers."—*Po Chüi (A.D. 772-846), translated by Helen Wiley Dutton and used with her permission*

The King of the Flowers, also called the Flower of Wealth, symbolizes spring and feminine beauty and is emblematic of love and affection

By MABEL IRENE HUGGINS

THE lipstick case of one of our much-advertised cosmetic brands is decorated with four flowers—the peony, lotus, chrysanthemum, and *mei-hua* or "plum flower." To the majority of Americans who use this make of lipstick, these flowers bespeak only a touch of beauty, but to the Chinese they are an expression of a year-round language of symbolism, for they are nothing less than the *ssu chi hua*, literally the "four season flowers."

The tree peony, commonly known as the King of the Flowers,



➤ THE KING OF FLOWERS and the Queen of Birds (the Chinese phoenix) form the motif of this embroidery pattern. Cut-outs like this are pasted onto cloth and covered with skillfully executed stitches

Drawing by Margaret Whitfield

hinese Symbol of Spring

is the symbol of spring. Its popular Chinese name, *mu-tan,* does not seem to have been mentioned before the sixth century of the Christian Era, although its herbaceous cousin, the *shao yao* [*Paeonia albiflora* (*P. Chinensis*)], was referred to as early as about 500 B.C., in the Book of Odes. In that ancient classic we find this reference:

> "So the gentlemen and ladies
> Make sport together,
> Presenting one another with
> small peonies."

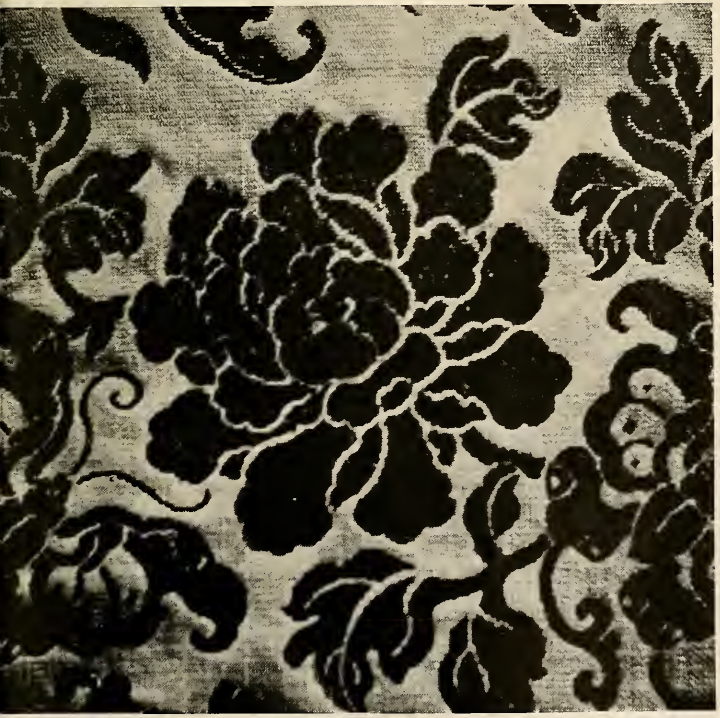
For long centuries, the tree peony has been held in favor by Chinese gardeners. It is known to Western science as *Paeonia suffruticosa* Andr. (*P. moutan* Sims) and is the only woody cultivated peony. According to botanists and explorers, it is native to China. Many varieties are grown in western, northern, and northwestern China and in Manchuria. At an early date these showy flowers became established in gardens. In 111 B.C. Emperor Wu Ti founded a botanical garden at Ch'ang-an, modern Sian; the capital of that day. It is possible that he introduced the peony into his imperial garden along with other plants.

Courtesy, Walker Art Center

▲ **Peonies** and two phoenix birds provide the ornamentation for this blue and brown chalcedony vase (18th-19th Century)

▼ **Textile designs** usually show the flowers in their natural forms: peony on cut-velvet

Corliss Hathaway photograph. Author's collection



We know with certainty that in the eighth century the tree peonies of the imperial garden were sufficiently important to be the center of attraction at gay parties given by Emperor Hsüan Tsung (A.D. 712-756). It was at such a function of revelry that the poet Li Po (A.D. 701-762) was called upon, though already inebriated, to use his inspired brush-pen. Sobered by the cold water dashed into his face, he produced three poems in adulation of the famous beauty, Lady Yang Kuei-fei, at the Imperial Feast of the Peony.

In the following century the general public could purchase peonies, if we are to judge from the record of Po Chü-i (A.D. 772-846). In one of his poems he tells that in the spring, peony plants were available in the flower markets at prices ranging from "five bits of silk" to "a hundred pieces of damask," depending on the number of flowers. Such prices were prohibitive to many, but even the tax-worried farmers of that time could at least gaze at the beautiful dark red blossoms and sigh over the fact that the cost of a single plant was enough to pay the taxes on ten humble homes.

In an eleventh-century treatise on tree peonies, Ou-yang Hsiu (A.D. 1007-1072) enumerates more than 30 cultivated varieties. At the same time wild ones were in great abundance, for another work of

▼ Moss-green jade box with peony scrollwork. Intricately carved peonies and a pair of long-tailed birds decorate the lid, at left (Ch'ien Lung period, A.D. 1736-1795)

Courtesy, Seattle Art Museum

the period says that in certain parts of the province of Shensi, the tree peony was so common that the people used it for firewood.

The success that attended Chinese gardeners in their cultivation of peonies is indicated in a fourteenth-century story that tells of a Sung-dynasty flower grower who had tree peony plants ten feet tall bearing flowers "as big as plates." His peonies "were not of the common variety, such as the 'Spring on the Jade Terrace,' but of the five rarest breeds. They were: the Yellow Terrace, Green Butterflies, Watermelon Red, Dancing Blue Lion, and Red Lion Head."* Modern Chinese florists still give names of a similar nature to present-day varieties of peonies.

Methods of peony culture mentioned in T'ang- and Sung-dynasty literature have become traditional. It was, and still is, customary to protect the plants from the sun by canopies of straw matting or cloth. Protection from wind is afforded by wattle fences or walls of rock or brick. A favorite location for peony plants was on the terrace, where they have been grown down to recent years at the Summer Palace near Peiping. According to Western horticulturists, the proper time for transplanting peonies is the autumn, but in China the roots are balled in mud and placed on sale at the markets right in the midst of the flowering season, an eighth-century method which has persisted into the twentieth century.

Another name for the tree peony is the *Lo-yang hua*, an allusion to its legendary banishment to Lo-yang, one of the ancient capitals of China. An old story gives an account of the impetuous whim of Empress Wu, who reigned from A.D. 684 - 705. One day in midwinter she issued a command that on the following morning all the plants and shrubs in the imperial garden should be decked out in their spring-time array of flowers. The next morning when the empress walked through her garden, she discovered that the peony alone had disobeyed her unreasonable decree. Angered at the peony's insubordination, she banished it to Lo-yang, whence, people now say, the best tree peonies come.

Amongst the Chinese proverbs that have originated in the mellow wisdom of an old civilization, there is this one: "Although the peony flower is good, it must have green leaves to bring out its beauty." With this type of indirectness it is easy to say that a leader may be good but he cannot be successful without the backing of his people. This same proverb has equal suitability for a wide variety of connotations; in each the peony lends its beauty to practical common sense.

The Chinese are an eminently practical people, so we may rightly expect that the "flowers of the four seasons" are put to some uses in a commonplace, everyday manner. Both the tree and herbaceous peonies are used medicinally. For one sort of medicine, the roots of the herbaceous peony are dug up in the second and eighth months and dried in the sun. The pharmacopoeia of the West may lack this drug, but before we scorn its efficacy as a specific for blood disorders and worms, we might do well to recall that our pioneer forefathers in the Midwest used to pour baptismal water over peony bushes as a charm against convulsions!

The "flowers of the four seasons" are especially interesting in their application to the arts and crafts of China. Each member of the flowery quartet has had a prominent part not only in inspiring Chinese poets and painters, but also in providing motifs for those Chinese craftsmen who have produced porcelains, textiles, embroideries, and objects of jade, ivory, lacquer, wood, and metal.

In paintings the four flowers are rarely combined in the same picture. A few exceptions exist, but they do not represent the usual practice. This rule does not hold, however, for porcelains, particularly those of the Ch'ing dynasty, during which floral designs were employed with the greatest lavishness. On vases, plates, and bowls of this period the "flowers of the four seasons" are commonly found in juxtaposition. The same is true of textiles. Lovely silk and velvet brocades, *k'o ssu* (silk tapestry), and embroideries often show the "four season flowers" in their most beautiful natural forms.

There are other combinations that should be noted. The peony is traditionally portrayed with long-tailed birds—the phoenix, cock, or pheasant. When the peony is associated with the phoenix, the King of the Flowers and the Queen of the Birds are represented, – a favorite pair which are to be seen in paintings and embroideries and jade. On porcelains the peony and the cock have nearly outrivaled the peony-phoenix combination.

---

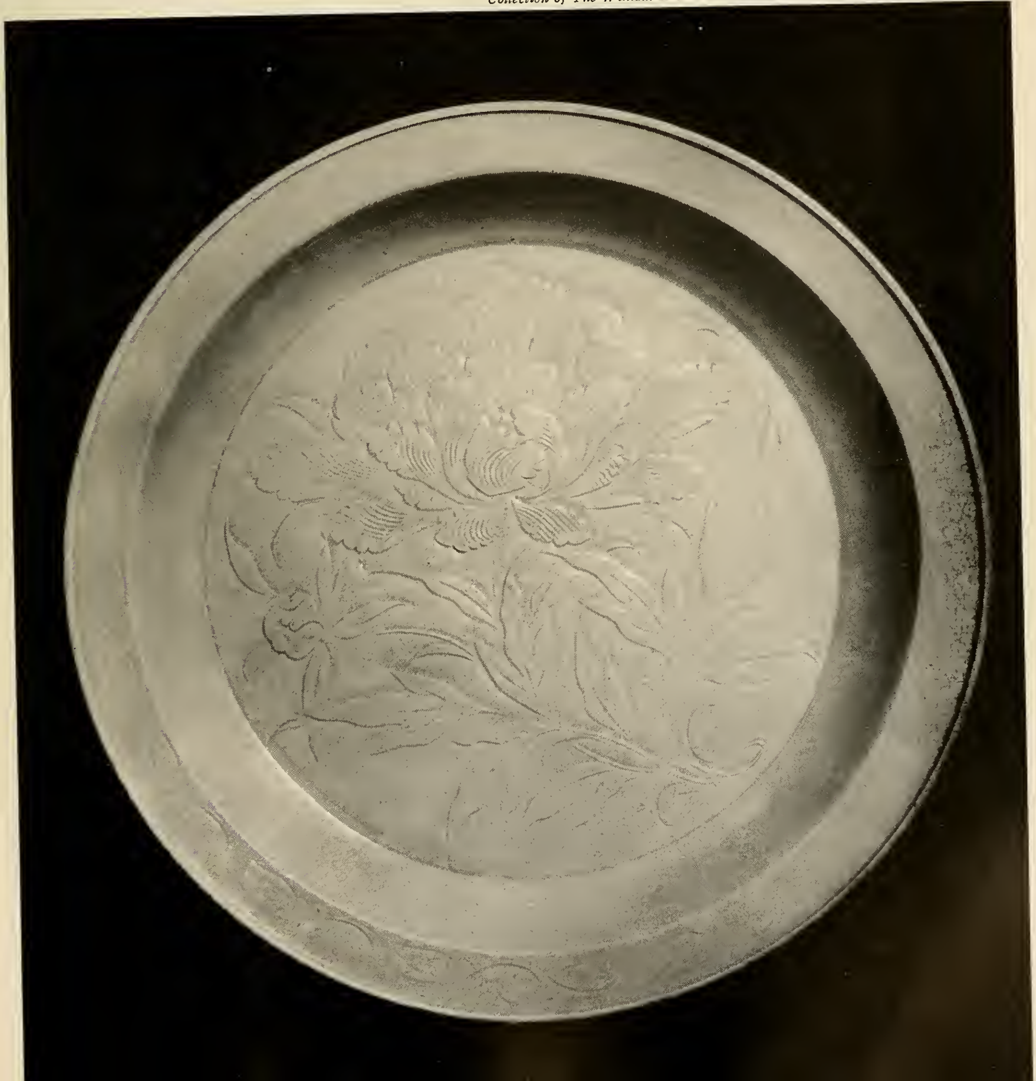
* From Wang, *Traditional Chinese Tales*, by permission of Columbia University Press.

The peony is frequently shown in the hand of Ma Ku, a Taoist goddess of longevity, and thus expresses a desire for long life accompanied by riches. This flower is considered the symbol not only of spring but also of feminine beauty, and in addition to that, it is emblematic of love and affection. Sometimes the peony is called the Flower of Wealth, a name that carries further symbolic significance.

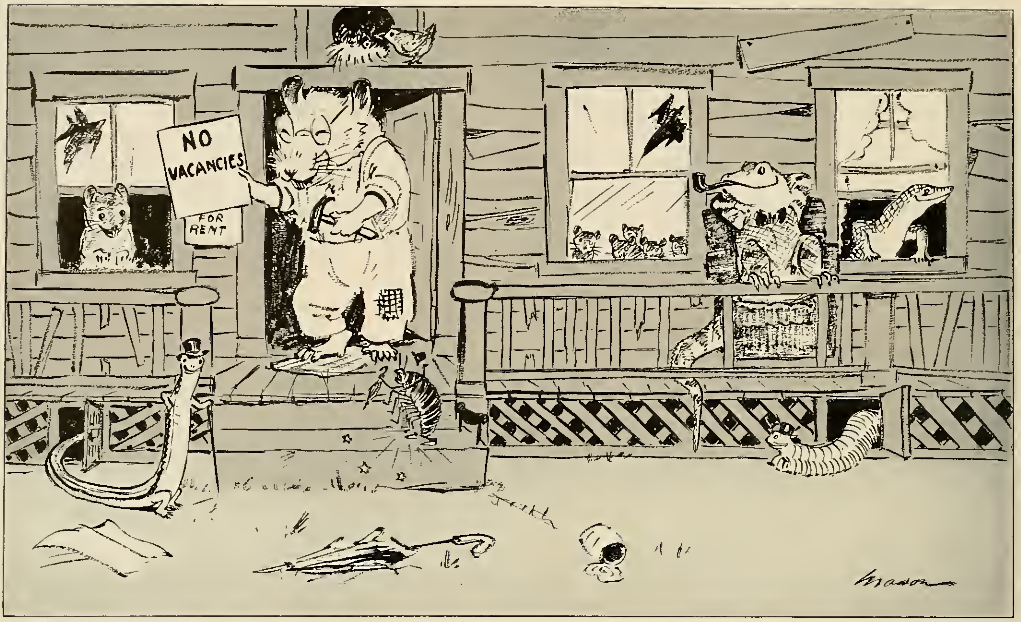
The craftsman of Peiping have fashioned in wood a particularly significant application of the "flowers of the four seasons." Street gateways to Peiping residences are constructed with projecting beams, upon the ends of which are sometimes carved, and gilded, the four characters, *ssu chi p'ing-an*, or "peaceful four seasons." In other words these four characters say, "To those who live within this courtyard, may there be peace through the whole year." Often in place of these characters there are beautiful carved and painted bas-reliefs of the "flowers of the four seasons." Their message is the same, a prayer not alone for China but for the whole world: "Throughout the four seasons, may there be peace."

▼ "ALTHOUGH the peony flower is good, it must have green leaves to bring out its beauty." A Ting ware porcelain plate which illustrates this principle (Sung dynasty, A.D. 960-1280)

Collection of The William Rockhill Nelson Gallery of Art, Kansas City, Missouri



HOUSING



By John Eric Hill
Drawing by
G. Frederick Mason

EVERYONE is interested in housing today, and many are suffering from the lack of proper living quarters. People are living in strange places, like Quonset huts, or crowding in with relatives. Animals, too, have need of homes, and sometimes they find them in strange places. On the chaparral-covered coastal hills of California and in the valleys where live oak, poison oak, and willows grow in profusion, the dusky-footed wood rats build large "houses" of sticks that serve as homes not only for these rodents, but for many different kinds of animals.

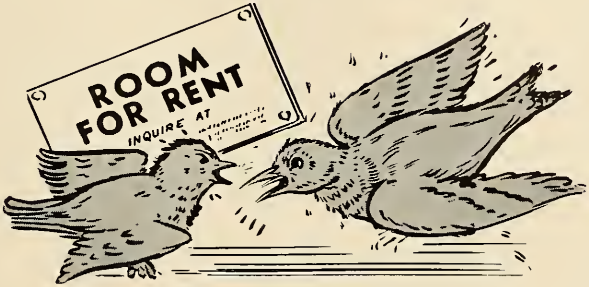
The houses made by these rats are roughly cone-shaped, about as high as they are broad at the base, and they may be more than six feet in these dimensions. They are usually built around the foot of a tree or in a dense growth of bushes, but some are built above the ground, in a tree or in a tangle of vines. In addition to the sticks and twigs of which they are chiefly composed, dead leaves, grass, pieces of bark, moss, and even earth may be added to fill up chinks. The pack rats will carry almost anything that is movable to the nest—paper, bones, tin cans, feathers, even old shoes and golf balls. The newly added materials are usually loose and somewhat haphazard, but weather and gravity settle them into place.

Deep inside the house, in a rounded chamber, the wood rat makes a nest of shredded grass and bark, often with some feathers, in which it sleeps and rests. Females keep their young in this nest. In an adjoining chamber the wood rats store acorns, seeds, and green plant material, while a place nearby serves as an "excretorium."

One of these houses provides a home for a number of other animals besides the wood rat owner. A wren may build its nest in the upper parts, while lower down may live several parasitic white-footed mice, the largest of their tribe in the United States. Rough-scaled fence lizards roam over the rat house and bask in the sunshine on it, while alligator lizards commonly live in the pile. When the house is built on the ground, salamanders of several species may make their homes in the base, among the rotting wood and leaves. Commonest of these is the worm salamander, with long, slender body and tail, and dwarfed legs. Besides these vertebrates, a whole host of spiders, mites, beetles, sow bugs, thousand-legged worms, and snails are found in or on the wood rat houses.

For the most part, relations between these animals and the "landlord" are good, but the parasitic mice undoubtedly pilfer from the wood rat's stores, and the lizards feed on insect and invertebrate fellow-lodgers when they can catch them. Perhaps least desirable of the tenants in this congested housing situation are the cone-nosed bugs, who suck blood from the wood rat and other mammals and may inoculate them with disease.

friendly enemies



By Lewis E. Potts

ONE morning, early last April, I heard a great commotion coming from under the hood that covers the track and wheels above some sliding doors at my home. The ground in front of the doors was littered with sticks, straw, string, feathers, and scraps of cloth, and it sounded as though there were dozens of birds defending themselves against some killer or band of killers in the hood. I stopped and had watched for perhaps five minutes, when, to my surprise, only two birds emerged from the open end, the only entrance or exit.

The first one was a European Starling, the next an English Sparrow, and to my surprise the sparrow wasn't chasing the starling. The starling was dragging the sparrow out, and when the starling reached the edge of the door, he dropped the sparrow, who fell limply to the ground. For fully a minute the sparrow appeared to be finished, then he moved, waddled around in a circle a few times, jumped to his feet, and started after the starling, who went into the hole. The sparrow brought out the other bird and proceeded to give him an awful beating. Evidently fighting inside this hood was an advantage to the starling, as the sparrow certainly gave him plenty to worry about on the outside. Immediately the sparrow started to take the string, straw, etc., back into the hole above the doors. He worked for possibly five minutes, then flew to the limb of a near-by tree and sat there as if waiting to see what would happen next. Quick as a flash the starling appeared and started to drag out the same material.

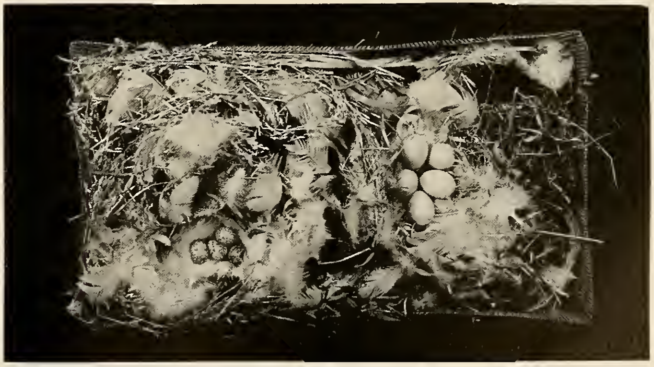
At intervals of about one minute, the sparrow would leave his perch on the near-by tree and fly straight for the hole while the starling was inside, but each time when he reached the entrance he would hover in the air for a few seconds, then fly back to the tree. He seemed to be trying to catch the starling as he emerged from the hole, handicapped with a load of nesting material, which would give him a few extra points at the start of the next round. The sparrow finally gained his objective, gave the starling another good, sound flogging; and the starling left as soon as possible, flying in a straight line as far as I could see. Then the sparrow again started to rebuild the nest. That same evening the battle was on again inside the hood above the doors. In a few moments out came both birds, the sparrow, in the lead, flying straight to the same perch on the tree. The starling started to carry the nesting material into the hole, though he refused to pick up any feathers that day or any other day that I watched. Yet his portion of the nest was lined with feathers, too, as can be seen in the photograph.

This tit-for-tat sequence continued until about the middle of May. Then the animosity appeared to be subsiding, and the squabbles were less frequent. About that time the starling was seldom seen. The sparrow spent a great deal of time on his favorite perch in the tree. Later on, the starling perched above the doors quite often, and then, after a few days, the sparrow and starling frequently sat on top of the doors about a foot apart. Sometimes one would go inside the hood, sometimes the other, sometimes both, the sparrow always first. Evidently they had called off the feud.

Now I became very curious and peeked inside; the sparrow was on the nest. The next day, I looked again, and out came the starling, flying almost straight into my eye. The sparrow was sitting on the nest at the far end; the starling was using the part near the open end of the hood. In the starling nest was one egg. A few days later each nest held two eggs. On June second there were five eggs in each.

At this point, I collected the nests, or rather nest, as it was built together like a double house—each bird having his own side. This would seem to be one of the most uncommon, unprecedented incidents of bird lore, since the general belief is that these two birds are irreconcilable enemies.

Photograph by the author



➤ **After more than a month of hostilities, the sparrow and the starling proved they were not irreconcilable enemies. They built their nests in one unit like a double house, as shown in this photograph, which was taken after the nests had been placed in a wire basket to facilitate handling**

Treatment for Ivy and Sumac Poisoning

By Willard G. Van Name

During the coming spring and summer, thousands of people will get more or less severely poisoned by poison ivy and sumac, and it is unfortunate that there is such a widespread lack of knowledge about a surprisingly simple method of treating such poisoning. It is not only beneficial in retarding the spreading of the eruption and hastening recovery, but is the only one that gives immediate and more or less lasting relief to the intolerable and incessant itching (which scratching only makes worse) that makes even a light case of poisoning a nuisance and a severe case a period of prolonged misery that only those who have experienced it can begin to realize.

This treatment is by the application of a moderate degree of heat. In more or less severe cases is usually best effected by immersing or bathing the affected parts for a few minutes in water hot enough to be slightly uncomfortable at first. Usually repeated brief immersions in water a little too hot for a long continued immersion to be tolerable will be most effective.

Water that is merely lukewarm or comfortably warm will not do the slightest good and may merely aggravate the itching, but somewhat hotter water will bring relief with a rapidity and, in most cases, a completeness that is astonishing and delightful to the sufferer, and usually lasts for some time, often several hours. If and when the itching returns, it is only necessary to repeat the treatment.

The patient himself will generally be the best judge of the exact temperature needed, which will vary in different cases. Normal care must of course be used to avoid scalding or burning the skin. If running hot water is available, holding the affected part under a faucet, or a hot shower bath may be convenient methods. In the case of children or those afraid to try water hot enough, start with quite warm water and raise the temperature gradually by pouring in hotter water.

Now it will be asked why, if heat is the effective factor, is not dry heat also applicable. It is; and this is important to know, for hot water in quantity is not always promptly and easily obtainable. For many light cases the only treatment required is to hold the poisoned surface for a few minutes near some source of heat such as a stove, an electric bulb, or a hot radiator, or simply hold a lighted cigarette half an inch, more or less, from the skin and move it slowly back and forth until the poisoned area has been covered.

This heat treatment in one form or another has been used with good effect by many people for a great many years, and why it is entirely unknown to the majority of people, not only in the cities but in the country districts, and to practically all medical practitioners (including army doctors, though many soldiers in training and in maneuvers in the eastern United States get terribly poisoned) is a mystery;—possibly it is because it is so simple that people either scoff at it and refuse to try it, or forget it before an occasion comes to test it. It is not mentioned in first aid manuals, in Boy Scout handbooks, in books on camping and outdoor life, nor is there a word about it in a special pamphlet on poison ivy issued by one of our large eastern universities. The remedies that such works usually recommend are the time-honored solutions such as Epsom salts, permanganate of potash, acetate of lead, calamine lotion, etc. Most people susceptible to ivy poison have tried these in vain many times. They have too little penetrating power to reach the seat of the poisoning, and they do little to relieve the itching, but heat can and does penetrate.

If the heat treatment were better known and understood, an immense amount of severe suffering would be avoided. It is especially important that those in charge of summer camps for city children should know of it and how to use it. Information from readers concerning their own experience with the treatment will be appreciated.

YOUR NEW BOOKS

Continued from page 155

(page 15)? *Begonia aconitifolia* is misspelled twice in captions between pages 52 and 53.

The many kinds of begonias today are classified according to the character of their roots into bulbous, tuberous, rhizomatous (with creeping stems), and fibrous types. They bear distinct, separate male and female flowers. Almost all like a cool, moist atmosphere, a condition not easily achieved in our houses in winter—though Mrs. Buxton advises firmly "open a door or a window . . . between ten o'clock in the morning and three o'clock in the afternoon . . . Try to give two hours of fresh air each day."

In the chapter devoted to soil-mixture the author sets forth almost as many and conflicting opinions by eminent begonia growers as there are recipes for Christmas puddings in cook books.

There are also chapters on seeds, cuttings, diseases, and begonia shows. An index provides some short cuts to facts. The illustrations comprise excellent half tones of growing plants and a number of line cuts of distinctive leaves.

G. H. H. Tate.

Stars
- - by William Alphonso Murrill

Published by the author, University of Florida, Gainesville, Florida
41 pages, paper covers, $2.00

In the preface, Dr. Murrill states that he wrote this pocket guide several years ago while he was teaching nature study to Girl Scouts, and he has dedicated the booklet to the Girl Scouts.

The first nine chapters are an imaginative story based upon astronomical mythology, each chapter preceded by a well-selected poetical quotation.

The second part of the book, consisting of ten chapters, is a simple and brief treatment of astronomy, and the third part is devoted to the constellations. No plates or figures are used in the book, but references are given to helpful books on astronomy.

Unfortunately the author uses the term light-year as though it were synonymous with parsec; and he has not brought his text up to date on the dimensions of the Milky Way Galaxy, on the magnitude of the largest stars measured with the interferometer, and on data concerning the largest telescopes now in use, but these matters are not of prime importance in a book of this kind.

Clyde Fisher.

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LETTERS

SIRS:

Photographing animal and bird heads is a hobby of mine, and I like to think of the accompanying two photographs as portraits. One shows a Bald Eagle, our national emblem; the other, a northern neighbor, the Canada lynx. Both were taken with a telephoto lens in the interest of safety, and although both subjects were caged, I was in their cages with them. Of course, a quick exit was planned, if needed. Previously a Great Horned Owl had fallen on my head in a cage, hence the caution.

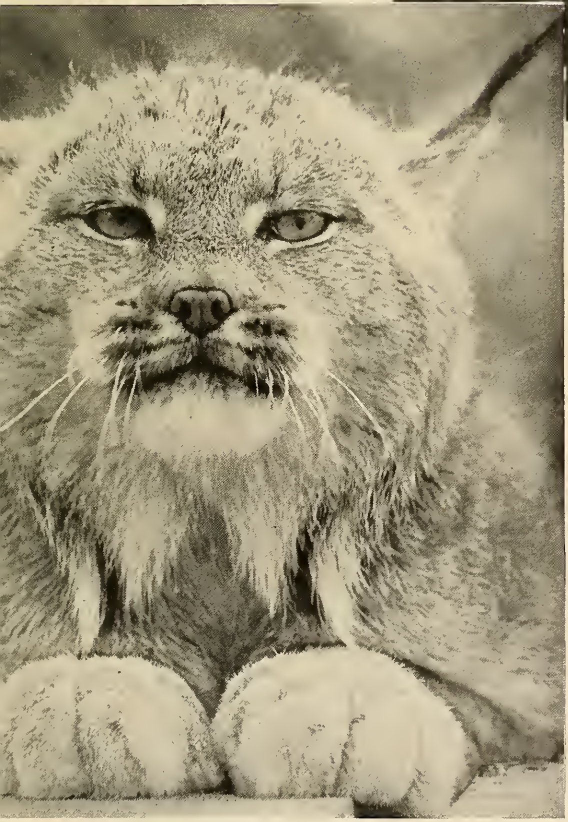
Malden, Mass.

LAURENCE LOWRY.

Continued on page 200

➤ BALD EAGLE

▼ CANADA LYNX



NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

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If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President ... Albert E. Parr, Director

VOLUME LV—No. 5 ... **MAY, 1946**

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THE COVER THIS MONTH

The American Egrets on our cover were photographed in full color by Helen Cruickshank near the headwaters of East River, deep in the mangrove 'glades of Florida. Here there is a great rookery where thousands of birds gather to nest. An Audubon Warden anchors his boat near by and remains on guard during the nesting season.

Watching the activity in the nests close to her blind in the middle of the rookery was as exciting to Mrs. Cruickshank as a three-ring circus. A big alligator often kept her company as he sunned himself near the blind where she was busy making notes on the behavior of the Louisiana Herons, Snowy Egrets, and White Ibises about her. When the egrets were nearly full grown, she took time out from her note-taking to capture in this Kodachrome view the beauty of their white plumage against the blue sky as they stood up to greet their parents.—Ed.

You will find Natural History Magazine indexed in *Readers' Guide to Periodical Literature* in your library

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Magazine subscriptions, Membership applications, and Advertising inquiries should be sent to Charles J. O'Connor.

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LETTERS

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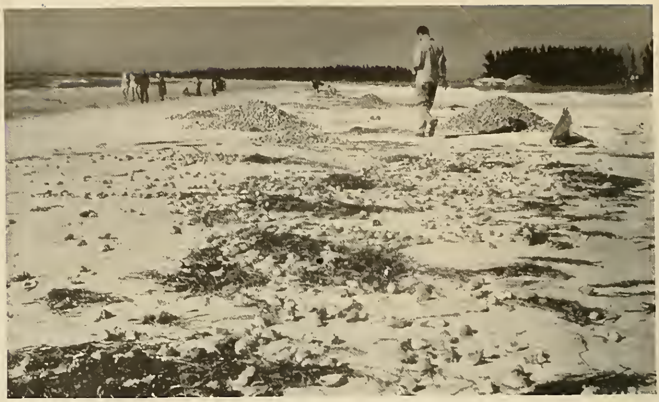
FIGHTING CONCHS



▲ One of nature's strange cycles of plenty: fantastic numbers of "Fighting Conchs" on the beach at Sarasota, Florida, where only a scattered few could be seen during the past 20 years or more

Sirs:

When driving through Sarasota, Florida, last winter, I noticed some excitement on the beach south of the Gulf View Inn. Approaching closer I found that the beach was littered with millions of "Fighting Conchs." There had been only a scattered few of these shells in the past 20 years or longer.

I know many of the people in Sarasota, and no one seemed to know where such tremendous quantities of conchs had come from. Nothing like this had ever been seen before.

Certainly this conch has little intelligence. It only kicks itself along using the sharp bony projection of its foot, landing wherever it happens to; but here they came ashore by the cartload.

It seems that from the latter part of November through the first part of January windy weather prevailed. The tides, which were quite high but not extremely so, scattered these shells well up on the beach.

A month later most of the shells I found were dead and clean, but some had dug in and still contained living animals.

Where have these animals been hiding all this time?

C. H. Stuart.

Newark, N. Y.

No doubt these thousands of conchs were individuals living in the rather near vicinity (that is, within a very few hundred yards) of the shore where they got stranded. Scattered over so large an area, their abundance would not seem extraordinary. Apparently some unfavorable condition, perhaps deficient food supply due to overpopulation, led to a slow mass migration. These creatures cannot travel far in any one day, but those that came close to the shore had to stop there, while others kept on coming and this presumably resulted in a large accumulation along the water's edge and dangerously close to it.

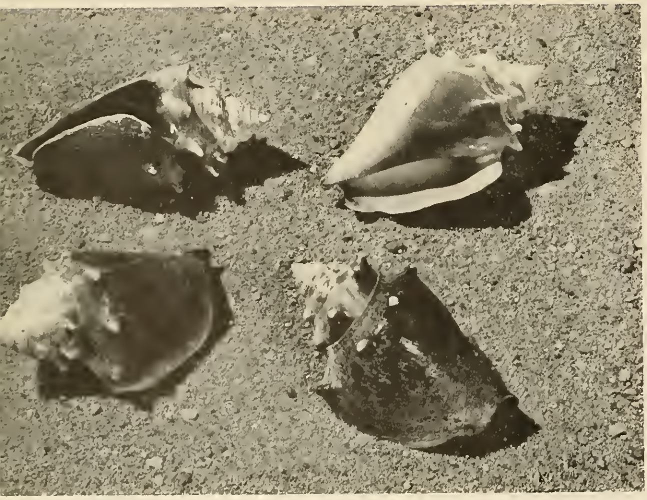
Then some unusual wind and tide condition might have left many of them so stranded that they could not get back into the water before exposure to the sun and air resulted in their death.

The conchs, in spite of their heavy shells, are quite active, predaceous creatures, and have a proboscis armed with small but sharp teeth. This particular species seems to be one of the more active ones, and will often put up a fight if incautiously handled. Its popular name, Fighting Conch, may however have been due to its Latin name, *Strombus pugilis*, given to it by Linnaeus.

Willard G. Van Name.

The American Museum of
Natural History, New York, N. Y.

▼ A close-up of the "fighting conch," a rather pretty shell about 3 inches long



➤ The shells were gathered by the cartload

SIRS:

Your March number has just reached me, and, as usual, I gave it preference, reading it from cover to cover.

Your article about the African Chameleon held added interest for me because of a small incident that occurred early last October—on a day when I had no film for my Kodak, worse luck!—right here in Northern Arizona, where I live.

I was sitting on the ground outside my trailer, when I saw a very small, very slender little lizard come up on the stone border right by my hand. Its tiny body, no larger than my little finger, was of the same tint as the lava rock on which it sat, but its long, threadlike tail was of a lovely shade of sky blue. All in all, the tiny reptile must have measured something short of four inches, the tail taking the longer half.

I sat quite still, and finally the lizard got off the rock and squatted on the gray soil. Fascinated, I saw its color change to gray, though the tail remained blue. I had seen many sizes and varieties of lizards during my many years in Peru, South America, but never before had I seen one that changed color.

Apparently sure that I meant no harm, the lizard moved up to the stone border and peered underneath it. Suddenly, with a motion almost too swift to follow, he darted under a large rock. From the opposite side, almost against my knee, came a terrified centipede of the dwarf variety so common to this region. The lizard was upon the creature in an instant; and as the hapless centipede turned to defend itself, its whole ugly head went pop into the lizard's wide-open mouth.

From then on, gulp after gulp, the frantically wriggling body of the centipede, its legs threshing wildly, began to disappear slowly but remorselessly down the lizard's throat. What held me spellbound was the fact that the body of the centipede was considerably larger than that of the lizard into whose insides it was gradually vanishing.

Finally the end of the centipede went down. The lizard stood in the warm sunshine, visibly swollen. I killed a large buzzing fly and placed it gently near him. The lizard eyed it, went around it, but the fly did not move, and the lizard was not interested. Instead, he saw a large moth alight on the soil near the stems of some nasturtiums. Another of his lightning movements, and the body of the moth disappeared into his mouth. The lizard climbed onto a lava rock and squatted contentedly in the sun, his face uplifted.

I did not see this lizard again until the spring. No doubt he was storing up provisions for his period of hibernation. The local people called this a chameleon, but except for his changes of color, he looked to me like any other lizard.

Is this species in any way related to

Continued on page 244

YOUR NEW BOOKS

FISHING ● NATURE PHOTOGRAPHY ● SNAKES
BIRD STUDY ● MAN-EATERS ● MALAYSIANS

THE PEOPLES OF MALAYSIA

------ by Fay-Cooper Cole

D. Van Nostrand Co., New York, 1945, $4.00
344 pages, 37 illustrations

PROFESSOR COLE wrote this book, he informs us, to provide a background of native life and history for those interested in the Malaysian world. This is a world that includes the southeastern portion of Asia and the adjacent islands of the East Indies and the Philippines; it contains some 80 million people divided into innumerable local groups. Since the sixteenth century it has been for Westerners a region synonymous with romance, adventure, and glamor. The very names of its harbors and its districts—Padang, Soerabaya, Macassar—carry to us the scent of spices and the mystery of an exotic life. It has also been the scene of a complicated sequence of population movement. From the mainland have come a succession of migrations, the most recent being the proto-Malay and the Malay, who are now the dominant people obscuring the traces of earlier populations and cultures, except for a few isolated groups. Historic invaders from the Indian peninsula, Chinese traders, Moslems, and Europeans have followed the Malay and brought further cultural complexities without, however, fundamentally altering the basic culture of their predecessors.

The highly varied patterns of culture which this history has produced can, however, be reduced, Professor Cole assures us, to a very considerable homogeneity by stripping off the veneer of Indian and Chinese influence, which is after all only skin deep. The underlying village structure thus revealed has a wide community throughout the area and is closely tied in with various mainland cultures which by this affinity suggest the origins of the insular Malay.

As specimen cultures the author presents and describes the life and customs of the Pygmies and the Sakai (examples of pre-Malay survivals), in addition to diverse groups in the Philippines, Borneo, Bali, Java, Sumatra, Nias and the Malay Peninsula itself. From these sources it becomes possible to envision the native life of Malaysia in its diversity and in its similarities.

H. L. SHAPIRO.

A LABORATORY AND FIELD MANUAL OF ORNITHOLOGY

-- by Olin Sewall Pettingill, Jr.

Burgess Publishing Co., Minneapolis, Minnesota, $3.50
248 pages, 20 plates, and other illustrations.

MERELY knowing birds by name is but a small beginning in their study, and fortunately many colleges and universities now offer courses in ornithology. Doctor Pettingill, gifted teacher at Carleton College, has provided this excellent manual for his students, to guide them whether studying a feather microscopically, learning the classification of birds, or observing the domestic affairs of hummingbirds.

The many chapters on bird biology are accompanied by black-and-white illustrations and maps and outline draw-

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ings to be filled in by the student. This is a thorough piece of work. The bibliographies are well chosen, and stimulating questions are interspersed in the text.

Equipment and necessary reference collections are listed at the outset, so it will not be supposed that this is merely another excursion-book. Under competent direction it will open a wide door into the world of birds, and serve as guide during a long and intensive course of study.

JAMES P. CHAPIN.

UPSTREAM AND DOWN

- - - by Howard T. Walden II

The Macmillan Co., $3.00
367 pages, 14 drawings

MANY of us now have our first opportunity to read Mr. Walden's volume on the art and philosophy of trout fishing. The first edition, published several years ago, was limited and brought $10 per copy.

The author is a modest angler, who does not claim to be an expert in the various ways of landing trout. However, his chapter on Methods, as well as every other chapter in the book, clearly indicates he is no novice in taking the brook trout, brown or rainbow.

The book cannot be classified as a technical one on the art of angling, and was not written for the man who is in a hurry. Instead, it is for the man who likes to spend an evening or two recalling the experiences he has had along various trout waters. Mr. Walden's book is full of philosophy which will carry the reader, if he is a fisherman, back to his youth when he first dangled a worm for a brook trout, through spring and summer seasons, and up to the thrill of landing a big one and the satisfaction of releasing him.

It will bring back a picture of your favorite pool on a hot, quiet June evening just as the rise is beginning and trout are dimpling the water, greedy for the hatch that has just come on.

Perhaps the most exciting chapter in the volume is the first one, "The Spark Is Kindled," for in it the author recaptures some of youth's magic—to use his own word for the time when our perceptions were keener.

The book is enhanced by Milton C. Weiler's beautiful pencil drawings.

TED TRUEBLOOD.

MAN-EATERS OF KUMAON

- - - - - - - - - - by Jim Corbett

Oxford University Press, $2.00
233 pages, 6 illustrations

MAJOR CORBETT has written an unusual and revealing book upon a subject of interest to a wide class of readers. The man-eaters are tigers that have made man their habitual prey, and in India the average countryman is poorly equipped to protect himself against such a powerful animal. A single tiger has held large communities in a state of perpetual terror, and the number of lives lost to an individual animal has run into three figures. The author recounts his experiences in hunting down some of these notorious killers, and his simple, unassuming style will impress the reader with its authenticity.

The gruesome details of the tiger's power over these simple people will doubtless shock some readers. They are appalling. Major Corbett has an extensive knowledge of tigers, based upon personal observation and experience. He has respect and even fondness for the rank-and-file tigers that leave man alone, but he is the nemesis of those that transgress the code. It requires high personal courage to seek out these killers, to play hide and seek as it were, with hunter and hunted alternating the roles.

Major Corbett went after his tigers the hard way. He usually hunted alone and often under circumstances that favored the animal. In this contest of wits the one who made an error of judgment or indulged in a careless moment lost his life. The man had numerous critical encounters, and on one occasion met the tiger wearing a smile in anticipation. However, when the smoke cleared, the smile was not "on the face of the tiger,"

MAN-EATERS OF KUMAON
JIM CORBETT

"This is so unusual a book, so far outside the usual range of our choices, you must be patient while I try to give you a fair notion of it. It describes the hunting of man-eating tigers (and occasionally leopards) that terrorized the hill villages of Northern India. It is no narrative of killing beasts for pride or prowess; it was, literally, a question of The Village or The Tiger. It is a story of murder (by the tiger), of detective skill and courage (of the solitary hunter), but also of natural history, of the life of primitive peoples, of marvelous scenic beauty, and an unconscious revelation of rare human character. In the details of tracking, we have all the thrill of the best detective story," says Christopher Morley in the *Book-of-the-Month Club News*.

MAN-EATERS OF KUMAON

by Jim Corbett   An April Selection of the Book-of-the-Month Club   Illustrated • $2.00

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thus confuting an old tradition of Niger.

With no intention of decrying the judgment of the Major or overlooking his eminent success, the reader may occasionally marvel at some of the casual preparations, such as carrying only three cartridges on a critical day, firing all, and finding the tiger still alive at close quarters. This time he needed luck.

H. E. Anthony.

Snakes of the North-eastern United States

- - - - - - - by Clifford H. Pope

New York Zoological Society, 50 cents
52 pages, 33 figures

THIS little brochure contains a great amount of information on the 23 different snakes known to occur in "New England, New Jersey, eastern New York and extreme eastern Pennsylvania." A brief general discussion is presented of the more important and interesting biological aspects of the snakes inhabiting the area treated. This is followed by a simplified "key" for identification, a detailed account of species, and a summary of snake venom and snake-bite treatment. A short bibliography of a few useful popular books is appended.

Thirty-three figures, two in color, illustrate the text. It is disappointing to see a few of the all-too-familiar old photographs of dead snakes in unnatural poses. However, Mr. Pope has done a commendable job in making the text both interesting and informative despite the handicaps of limited space and necessary simplification. Residents of the northeast will find that this pamphlet contains a useful and concise treatment of their native snakes.

J. A. Oliver.

Three Mile Bend

- - - - - - - - - by Kerry Wood

The Ryerson Press, 229 Queen West,
Toronto

THERE is a place within walking distance of every city, town, village, and hamlet where wild things grow and untamed creatures meet. It may be only a clump of trees on a hilltop or a shady nook by a chattering brook. It matters little where it is, but here can be found the story of wildlife for those who choose to read it. Three Mile Bend is just such a place, and Kerry Wood gives his version on the drama of wildlife played there. The Bend is downstream from Red Deer, Alberta, within walking distance of the town, yet far enough away from human habitation to make it a reasonably safe rendezvous for the creatures of wildwood. The author has presented his plea for the conservation of wildlife in a new and amusing manner. It is in all a happy book, full of laughs and romance. In portraying the human side of native wildlife, Kerry Wood has perhaps used the author's prerogative to the extreme, but in so doing gained a point that could scarcely be presented in any other manner.

The crowning feature of the entire book is that it is centered around the common and small creatures that are more or less familiar to every one of us. It makes a dell or a strip of woodland a world of beauty and a place of adventure and enchantment. Mr. Wood brings out the charm of it all and reports whatever he has learned on the ways and manner of each wild thing. He fills the air with wings making music and brings to light a host of wild creatures that live on the ground and hide in the trees. If each individual were capable of thought and speech, Kerry Wood gives his interpretation of what they would talk about—and believe it or not, there would be nothing complimentary about the human race.

G. G. Goodwin.

Outdoors with a Camera in Canada

- - - - - - - by Dan McCowan

The Macmillan Co., $2.50
102 pages, 47 illustrations

IF you enjoy good reading and illustrations to go with it, here is a nice little volume to satisfy you. The presentation is excellent and the method is to be recommended for subsequent pictorial publications. Each picture with a descriptive text occupies a double spread, thus forming a complete unit. The author has

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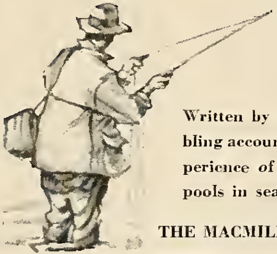
UPSTREAM & DOWN by Howard T. Walden, II



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Photographs by Edwin Way Teale

▲ Ever ready for flight, Anax could take off on his powerful, amber-tinged wings more suddenly even than the birds. He made few landings as he scoured the air above the cattail-fringed pond in search of midges, mosquitoes, and other winged prey

The Two Lives of Anax

Life in the water and life in the air present different problems to *Anax junius*, the green darner

By Roy L. Abbott

Professor of Biology,
Iowa State Teachers College

"Like a hen harrier beating the bush for game," as Thoreau aptly phrased it, the big dragonfly had from early morning been making high, circling sweeps over his domain—the long, cattail-fringed pond. Up one side and across its far end, out around that weedy point, down the length of a fallen tree, and back along the wooded side of the pond—over a sort of beaten but invisible path—he moved in tireless, shuttling flight, his insatiable appetite driving him ceaselessly. Only once or twice, in fact, when the swarms of midges had temporarily subsided, did he leave this fixed route. Then he momentarily moved inward off the water to quest along the tree trunks for his quarry, going slowly up and down them, his gleaming head only a few inches from the bark,

◄ The big green dragonfly had developed from an egg inserted by his mother in the stem of a cattail

(Harold M. Lambert photo, from Fredric Lewis)

his wings rustling dryly as if to flush the resting insects from their concealment.

The pond was not, in truth, exclusively his domain. He had not been alone in his hunting. He and many other kinds of dragonflies and damsel flies had been flying together all morning, but at different levels. The big fellows, like himself, flew the highest; the tiny bluets, lowest; and the others of various sizes and speeds at different levels between, each layer keeping, as if by agreement, a rather constant distance between itself and the next. For the powers of flight in the dragonflies depend directly upon their size and the strength of their wings, and those of like kind seemingly wish to stick together.

The life of an adult dragonfly lasts only a few weeks at most, and as if aware of this fact, this king among all the insect-flyers, seems impelled to spend almost every moment of daylight upon the wing. Some, actually hunt late at night. Long after the strictly dayfliers have gone to rest, they may be seen in relentless pursuit of the early mosquitoes.

Tyrant of His Realm

But for the moment, at least, the big green darner, *Anax junius*, the central figure of this tale, was making one of his few stops of the morning. Yet, even now, perched on his six spiny legs atop a high branch overlooking the pond's mirrored surface, he appeared, though at rest, the very embodiment of power and motion, a lean, ferocious hawk of the insect world—a miniature fighter plane on its airstrip ready for the take-off.

At a distance of a rod or more, his olive-green body, bulging with its powerful wing-muscles, distinguished him from all the other dragonflies of the North. A closer scrutiny would reveal, too, a black central spot in his forehead, ringed first with blue and then with yellow; and his narrow four-inch wings were clear, closely netted, and tinged with amber. Also, these wings, airplane-like in both appearance and structure, were laid straight out when he was at rest, unlike those of the damsel flies, which are commonly held together above the back. Because of this horizontal position of his wings, with their cutting edges held obliquely upward, Anax could launch himself instantly into the air by a simple sculling action; swifter was he even than the birds in his take-off.

Unable to Take One Step

Perched on his high look-out, Anax, the darner, made no attempt to move along the twig that supported him. Indeed, though possessed of six long legs, he could not walk a single step. His legs were fitted for clinging and climbing instead, and, once in the air, they served for yet other functions—they became a snare and a lunch box in one. For Anax captured his prey on the wing, and no retiarius of old was more deft with his net than he. As he swooped close over their backs, those relatively feeble fliers, the midges and mosquitoes —yes, even now and then a moth or occasionally a lesser member of his own tribe—were swept into his deadly snare, the spiny basket formed by his long reddish legs, elbowed and held forward. Each victim was plucked out and devoured in flight, its detached legs and wings trailing in Anax's swift wake.

Also, as he rested, his immense head which, save for its keen jaws, was composed almost entirely of his two great gleaming compound eyes, kept turning restlessly, twisting through half a circle while he flew. He could see above or below, ahead or behind, with equal ease, and few creatures great or small that came within range escaped his vision.

Some were pursued, but some were avoided. For, ferocious and terrible ogre that he was to lesser creatures in the air, he had to be ever on the alert for those that would make a meal of him. Below him, among the cattails, for example, were the pop-eyed and wide-mouthed frogs, which could gobble a dragonfly easily, wings and all, even one of his size. In the air above and among the trees on the banks, were the swallows and the kingbirds, and less open in their hunting of his kind, the shrikes and cuckoos and the smaller hawks. Indeed, it was the way of the kingbird to wait perched on some vantage point until a dragonfly became careless, so to speak, as the result of being absorbed in courtship or the chase, and then to swoop down upon the unwitting victim.

Anax was always hungry. Scores of midges and mosquitoes and Mayflies had gone into his voracious stomach that morning, but even as he rested, his hunger goaded him. It required an enormous amount of food to keep his big thoracic muscles contracting fast enough to move his wings at some 28 beats to the second and to drive that streamlined body of his 60 miles an hour, if need be. If his pond dried up, he would move miles inland from water, if necessary, to some farmyard, say, where the flies and the honeybees would provide his daily meals; for food he must have, and in plenty.

His Day In The Sun

This was Anax, the big darner, as he clung there to his perch, his amber wings glinting in the August sun. But beautiful and perfectly functioning machine that he now was, he had been thus for only a few short weeks. Two months before, he, or rather the being that later was to transform into him, had been shielded from the sun in the waters of this very pond—an ugly, crawling creature hiding in its depths. And a year before that he had been yet different—a mite of an egg only 1/25 of an inch long, thrust by his mother's ovipositor into a punctured cattail stem. For unlike other dragonflies (the Raggedy skimmers and the Windsprites, which likewise used the pond as a hunting ground and a breeding place), the female Anax never deposited her eggs freely in the water to be scattered loosely over the mud at the bottom. Her egg-laying apparatus had left in the stem a double row of punctures as neat as the stitching of a sewing machine—punctures which housed the egg from which he had come, along with others that had produced some scores of his brothers and sisters.

She had backed down the stem until entirely submerged before placing the eggs, but this had been the only care that she had ever given her off-spring. Three weeks after it had been laid, the egg that was to become the big darner of this story hatched into a one-tenth-inch-long, spider-like creature scarcely more like a dragonfly in appearance than a cabbage worm is like the white butterfly that produces it. It had one important characteristic, however, in common with its parent; it, too, was a dragon—not of the air but of the water—a ferocious flesh-eater, as are the young of all dragonflies.

Young dragonflies are called nymphs or naiads. All are carnivorous and all must live in water, but they differ greatly in appearance and behavior. Some are burrowers in the mud, ploughing through it by means of their wedge-shaped heads or lying quietly just below its surface awaiting their signal for action—the jarring steps of their unsuspecting prey just overhead. Still others are sprawlers who, masked by a covering of adherent silt, lie in patient ambush until some victim blunders within range. So sluggish are they that those strange creatures, the Bryozoans, may grow upon their bodies and thus anchor them in place.

The tiny long-legged nymph that was to become Anax, the green darner, was yet different in behavior from all these. He was a climber, an active fellow who spent his time crawling among and along the stems of the cattails and the waterweeds, his pale green, brown-streaked body blending perfectly with his surroundings. He would hang quietly head downward until some hapless damsel fly nymph or tiny fish or tadpole came within reach of his jaws. More often, however, but still stealthy as a hunting

▲ THOUGH he had six long legs, he could not walk a step. This tyrant of the air was a far cry from the jet-propelled "submarine" from which he had developed a few weeks before

▼ THE LIFE-SPAN of this miniature fighter plane would be only a few weeks. His olive-green body, bulging with wing muscles, made him the personification of power and speed

cat, he would slide slowly forward with head low until within half an inch of his victim before striking. Then would occur one of the strangest happenings in nature—a stroke so swift that the human eye could not follow it—an out-thrusting and a withdrawal of his terrible lower lip. There is nothing else like this among animals.

This lower lip, which is armed with a pair of grappling hooks at its front end, is hinged at about the middle, and when not in use, is kept folded back beneath the head, the hinged joint lying between the legs. From in front, the nymph's face presents a masklike, squarish, bull-dog appearance, giving no hint of that awful lip which can be shot forward like a telephone rack to grasp its victim. The hooks hold while the jaws consume, and the fragments fall upon the inside of the lower lip, later to be picked up and devoured.

Each Anax nymph can eat its weight of other creatures in a day's time or less; it asks only that its food be alive and on the move. Each is a cannibal, as well. Place a number of various sizes and kinds of dragonfly nymphs in the same quarters, and presently only one or two of the largest are left.

Enemies

But insatiable as was Anax, not all of his time was spent in the chase. Part of it was utilized in keeping away from those who chased him. For just as his winged parents in the air above had to be eternally vigilant, he, too, was compelled to be ever on the look-out for his enemies—many different kinds of fishes, and turtles, and the larger nymphs of his own kin.

Also, he had often to take time out for the molting process; for as with all insects, his inextensible armorlike coat precluded growth beyond a certain point. When this limit was reached, molting was inevitable, a process that occurred probably a dozen times during his aquatic life.

At hatching time he had no sign of wing buds; these did not appear until his fourth molt. But each molt thereafter found him not only with his wing covers longer but with his body larger and stronger, his appetite more ravenous, and his temperament more ferocious. He was building—although, of course, unknowingly—to become a real winged dragon of the upper air!

During his more leisurely wanderings through his watery domain or when silently stalking some victim, which was often nearly as large as himself, he used his legs for locomotion. But when he darted swiftly but jerkily ahead of some pursuing foe, an observer might well have wondered by what strange means he moved; for then neither legs nor appendages propelled him.

That same observer, however, watching him more closely, might soon have discovered his strange method of locomotion. For whenever a nymph "takes off" from the bottom of a pond or darts past some silt-covered weed, a little cloud of silt may be seen behind it, just as silt may be thrown back by water from the propeller of a motor boat. A little examination will disclose that the creature's hind intestine is enlarged to form a cavity into which water enters, to be forcibly ejected by contraction of muscles in its walls. Anax moved by "jet propulsion" in its most primitive form!

But as if this alone were not strange enough, the Anax nymph made yet another use of his jet-propulsion apparatus; he breathed by it, as well. For projecting into the cavity of this rectal water-chamber, which filled nearly two-thirds of his abdomen, were 12 rows of thin gills for taking oxygen from the water that bathed them. His equipment for breathing and locomotion was thus perfectly combined in one: the incoming water brought him oxygen, the outgoing water propelled him—carrying, with it, also, the waste products of his body.

Thus the Anax nymph lived and had his being in the cattail-fringed pond. He had been hatched in June of the preceding year, and now, nearly eleven months later, as a result of all his eating and molting and growing he had come to the end of his nymphal span, and a marvelous change was at hand—one that would transform every circumstance of his life. He was to rise from water to air, to shed his drab, ugly form and to take on a winged, shimmering, iridescent, birdlike shape, just as those which even then were fanning ceaselessly above his head.

Preparation By Fasting

Anax, the nymph, was aware of none of this, of course; he moved only in response to internal impulses, one of which caused him even to leave off his eating, hitherto his most fundamental urge. For several days preceding the coming great drama, he took no food, but merely clung quietly to the stem of a reed. But soon, moving again by inner and mysterious impulse, he actually climbed up the stem until he was entirely above the water—a thing he had never done before—, grasping the stem strongly with sharp claws as if realizing that a fall during this period of transformation might be fatal.

And there, for a time, he hung as if dead. Presently, however, tremors shook him, and a narrow cleft appeared in the skin behind his head, running backward and forward until it passed between his wing pads and across his head between the eyes. Through this rent something appeared—it was the back of the emerging adult. Next came the head, then the legs and the crumpled wings, and the slender abdomen last of all. A dragonfly had been born.

For an hour or two he clung there to his old coat, helpless and soft at first. But dryness and strength and color came with the sun, and with food, and presently *Anax junius*, the green darner, snakefeeder, devil's darning needle, flying adder, mosquito hawk, or whatever men chose to call him, took off in shining beauty on his tireless patrol of the cattail-fringed pond.

LOST Continents

Ever since the days of the Greeks, people have tried to prove that thriving civilizations once existed on huge islands that have since sunk beneath the sea. Here is a scientific view of the question

By L. Sprague de Camp

THE name "Atlantis" evokes a picture of a beautiful world with a high and colorful culture, now, alas, gone forever, but still celebrated in story and controversy. What about Atlantis, Lemuria, and other "lost continents?" Is there "something to it?"

Men have always yearned for a land of beauty and plenty where peace and justice reigned. Failing to make one in fact, they have consoled themselves by imagining Edens, Utopias, and Golden Ages. Formerly they put them in the remote past or in unexplored places. Now that most of the world has been explored and human history is fairly well known, they put them on other planets or in the future.

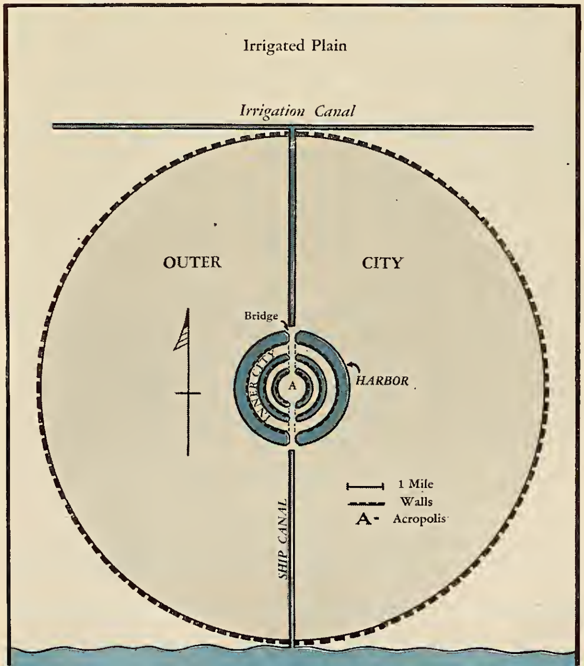
One of the most successful creators of ideal communities was the Greek philosopher Aristoklés the son of Aristón, better known as Plato. Around 355 B.C. he wrote two Socratic dialogues, *Timaeus* and *Critias,* in which is set forth the story of Atlantis. Except for Plato's tale and the commentaries on it by his successors, there is not another word about Atlantis in the Greco-Roman, Egyptian and Babylonian literature that has come down to us.

In *Timaeus,* Critias explains that he got the story from his grandfather, who got it from *his* father, who got it from the statesman Solón, to whom it had been told by a priest of Saïs, in Egypt.

The story is that 9000 years earlier there had been a great Athenian empire, organized along the lines that Plato had set forth in his *Republic.* The state was ruled by a communistic military caste, and everybody was brave, handsome, and virtuous. There had also been a mighty empire of Atlantis, an island west of the Pillars of Hercules, larger than North Africa and Asia Minor combined. This power had tried to conquer the Eastern Mediterranean but had been defeated by the Athenians. Then a great earthquake devastated Athens, swallowing the Athenian army and the whole of Atlantis. Hence the seas west of Gibraltar were unnavigable, because of the shoals which were all that was left of Atlantis.

The remainder of the dialogue has to do with the natural sciences. In the next dialogue, *Critias,* there is more about Atlantis. When the gods divided up the earth, Poseidón received Atlantis. He begat ten sons, and divided the land amongst them. They were to rule it as a confederacy of kings, and the eldest, Atlas, was to be head king. The land was marvelously productive, with minerals and elephants. The descendants of these kings built the city of Atlantis. It was circular, about fifteen miles in diameter. Through the middle ran a canal connecting the sea with a great

▼ Modern legends of lost continents have their roots in early Greek fantasy. This diagram shows Plato's idea of the capital of the Empire of Atlantis, supposed to exist on a vanished island west of Gibraltar. The rings of land surrounding the Acropolis and royal palace contained parks, temples, barracks, and a race track



rectangular irrigated plain on the far side. The plain was about 230 by 340 miles. In the center of the city was the citadel, also circular, about three miles in diameter, comprising concentric rings of land and water. The land rings were interconnected by bridges, and the water rings by tunnels large enough for ships. The palaces and temples were lavishly decorated with gold, silver, brass, ivory, and a mysterious *oreichalkón*, "mountain copper," which "glowed like fire." There is no word of explosives, searchlights, or airplanes, with which imaginative modern Atlantists have credited the Atlanteans. The only ship mentioned is the trireme (*triéré*), and except for oreichalkón, Plato described no technics not known to his own time.

The kings met every fifth or sixth year to discuss matters of state, which they did after sacrificing a bull with much ceremony. For many generations the Atlanteans were virtuous like the Athenians of that day. But in time they suffered a moral decline and became ambitious and greedy. Zeus decided that they needed chastisement. He called the gods to his palace to discuss the matter, ". . . and when he had assembled them, he spoke thus: . . ." Here the dialogue ends in mid-sentence. We never learn the details of the Atheno-Atlantean war.

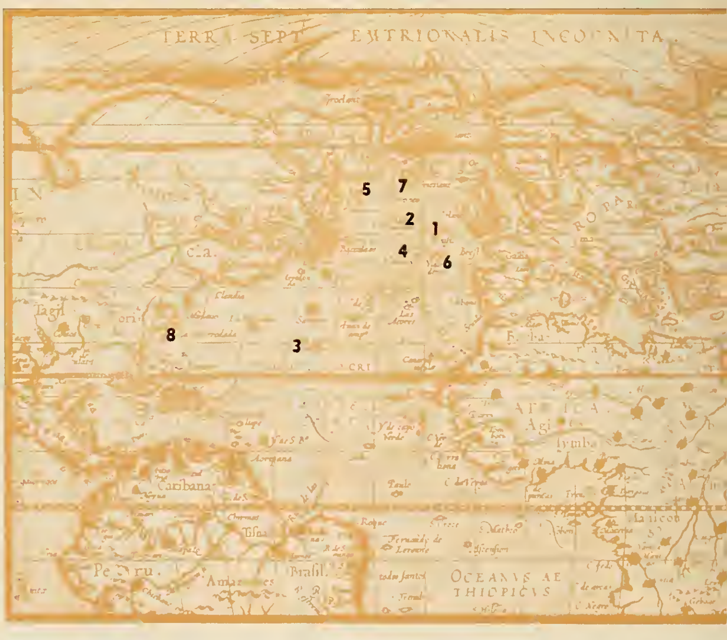
Aristotle, Strabo, and Pliny assumed that Atlantis was a fiction, an allegory by which Plato intended to expound his social ideals. From what we know of Plato, this would have been quite in character. In the later Roman Empire, critical standards, which had never been high by modern ideals, declined still further, and people like Proclus the Neoplatonist began to take the tale seriously.

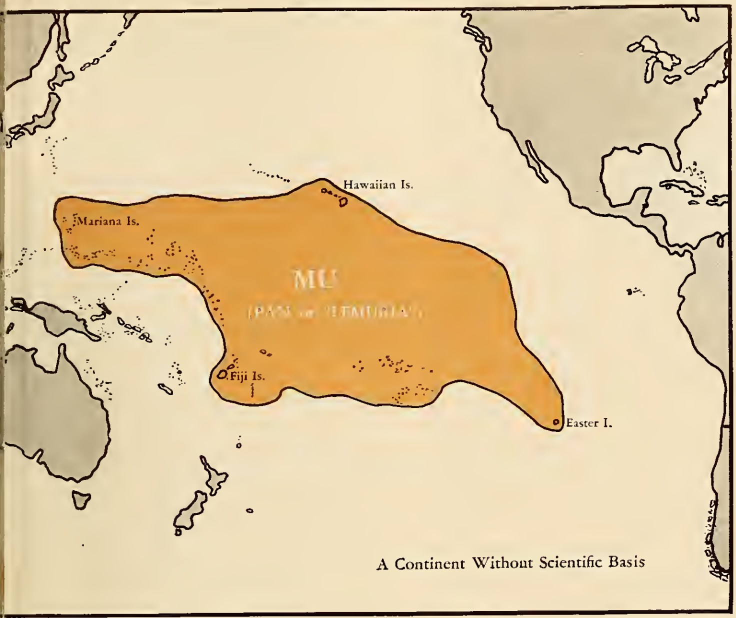
After the sixth century little more was heard of Atlantis until the beginning of the European Age of Exploration in the fifteenth century. Then rumors of new lands ran riot, and the Italian and Iberian explorers were often far from exact in their reports. The maps were covered with geographical fictions. The Atlantic in particular was spotted with nonexistent islands, sometimes including Atlantis, even though it was supposed to have sunk. One ghost that was not exorcized from the maps until the nineteenth century was an island supposed to lie about a hundred miles west of Ireland. It was known as Brazil or Hi-Brazil. In 1674 a Captain Nisbet arrived in Scotland with some "castaways" which he claimed to have rescued from Hi-Brazil. He said the island was inhabited by large black rabbits and by a magician who had been keeping the castaways captive in his castle until the gallant captain had broken the spell that bound them. Unfortunately there never was any such island.

The writing of fantasies about ideal commonwealths flourished at this time. Sir Francis Bacon wrote *The New Atlantis,* which he located in America. Sir Thomas More composed his celebrated *Utopia* ("Nowhere"), and was disconcerted when people wrote him seriously urging sending missionaries to convert the Utopians to Christianity. This is an old and well-developed art; the Hellenistic writer Iamboulos had written shortly after Plato's time about an island in the Indian Ocean where people lived according to the rules of Stoic philosophy. If Plato's tale is in this class, it is in lots of good company.

The discovery of America loosed a flood of pseudoscientific speculation about the origin of the American Indian, and this has continued to the present, despite the fact that the sciences have pretty well established that they came from Asia via Alaska. People who met the natives for the first time jumped to the premature conclusion that they were speaking Welsh and were the descendants of Prince Madog and his band, or were practicing Hebrew religious rites and were the Lost Ten Tribes. As an-

▼ MAPS in the century following Columbus were sometimes peppered with islands that did not exist. This section of Ortelius' World Map of 1570 includes the fictitious (1) Isle of Brazil, just west of Ireland, (2) St. Brendan's Isle, (3) Isle of The Seven Cities, (4) Green Island, (5) Isle of the Demons, (6) Vlaenderen, (7) Drogio, and (8) Emperadada





A Continent Without Scientific Basis

▲ The imagined continent of Mu, sometimes called Pan or Lemuria by the occultists, in the central Pacific, where it is unlikely that any continent ever existed. Another "lost continent" proposed by the Scottish mythologist Lewis Spence linked the Oriental zone with the Australian and thus disregarded one of the sharpest faunal boundaries recognized by scientists

thropology and linguistics hardly existed, such assertions could not be disproved. Since then interest in Atlantis has fluctuated, but more up than down. Today Atlantism is a small but durable cult that enables publishers to issue a new Atlantist book every year or two. Beyond the cult itself, there is a fairly wide public who finds the idea of lost continents romantic and appealing and has never heard the scientific side of the story. Atlantism was stimulated in 1882 by Ignatius Donnelly's *Atlantis: The Antediluvian World.* Donnelly was a Philadelphia lawyer who moved to Minnesota and led an active political career there. He had an active but uncritical mind which absorbed a vast amount of information and misinformation. He was enthusiastic and expert at arguing from a molehill of fact to a mountain of surmise. He also wrote *The Great Cryptogram* to prove that Bacon wrote Shakespeare. Some unkind cryptographer pointed out that by Donnelly's methods one could easily prove that Shakespeare wrote the Forty-sixth Psalm.

Donnelly argued that small islands have disappeared in eruptions, so why not a continent? He cited many alleged resemblances between the appearance and cultures of the peoples of the Americas, Europe, and the Near East, and insisted that, therefore, the civilizations of all must have come from Atlantis. His arguments are not impressive when scrutinized. The common origin of Europeans and American Indians is argued from the fact that both practiced marriage and divorce, that both used spears, and that both believed in ghosts and flood-legends. Such argument merely shows that these people were human beings, for all these attributes have been found all over the world, in Asia, Africa, and Australasia as well as in Europe and the Americas.

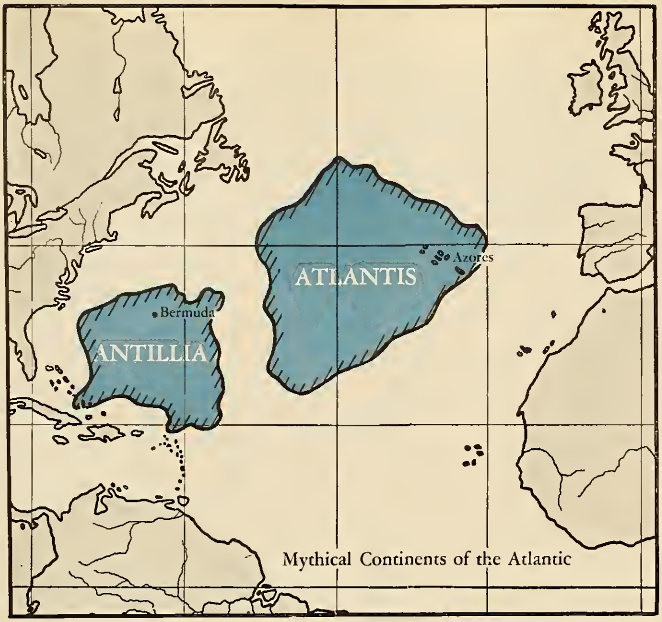
His "proof" of the relationship of Egyptian and Mayan writing is to take the phonetic values given the Mayan characters by Bishop Diego de Landa, line them alongside the Egyptian signs, and concoct "intermediate forms" to reconcile their glaring differences. He did not know that de Landa's "Mayan alphabet" was a hoax played on the bishop by the Indians, who hated him for having burned nearly all their native literature.

Donnelly's linguistic arguments are of similar worth. He gives a comparative table of Chinese and Otomi words, which does not inspire confidence when we discover that his Chinese words for "head," "night," "tooth," "man," and "I" are wrong, or at least not the standard words in the Chinese National Dialect (Donnelly: *ten, siao, tien, na, nugo;* Standard Chinese: *tou, ye, ya, ren, wo*). In the Otomi language of Mexico, as in Chinese, the pitch at which a syllable is pronounced makes a difference in the meaning. Some speculators have inferred herefrom that Otomi is related to Chinese or Japanese, a surmise that is not borne out by even a slight acquaintance with these languages. Several African languages also have tonal distinctions.

For all its faults, Donnelly's book became the New Testament of Atlantism, as *Timaeus* and *Critias* are its Old Testament. Year after year Atlantists repeat that Otomi is archaic Chinese or Japanese.

Modern Atlantism has been incorporated into the doctrines of the occult societies, which have much more colorful stories to tell than did Plato—of Atlanteans with airplanes and vast magical powers, and bisexual Lemurians with astral bodies only. Outside of occultism, Atlantism is a fairly small cult, comprising a few writers and their faithful readers. Even if Plato's story were true, there would not be much one could *do* about the sunken continent.

In Europe secular Atlantism has been more ambitious. Clubs like the *Société d'Etudes Atlantéenes* have been formed. The members have gone on picnics with Atlantean emblems in their buttonholes, printed Atlantean stamps, and met



▲ ACCORDING TO LEWIS SPENCE, the lost continent of Atlantis was inhabited by members of the Cro-Magnon race, which is known through authentic investigations to have inhabited western Europe in the Old Stone Age. Geologists, however, are unconvinced that there were any large land masses in the Atlantic during man's period on earth

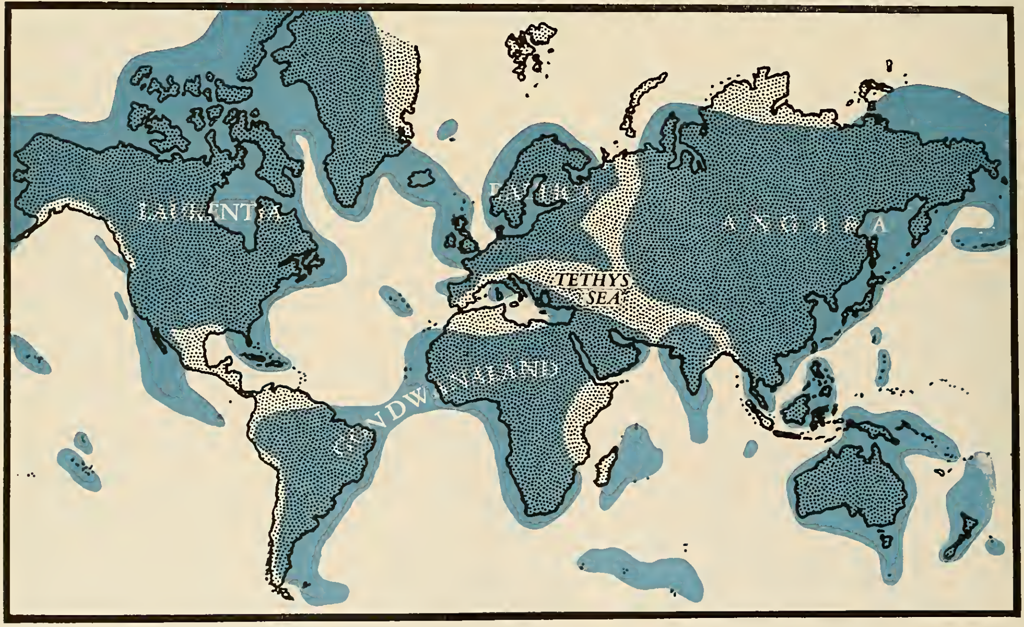
periodically to read papers. At a meeting in France in 1927, a heretical faction threw stink-bombs into a discussion of ancient Corsica.

One can treat the "problem" of Atlantis in several ways. One can analyze Plato's story as a piece of fiction, or search for a real ancient culture corresponding to Plato's confederacy. One can investigate Atlantic islands or land bridges from the point of view of geology and biology or, like the occultists, swallow Plato's tale whole and expand it by inspired imagination.

We have scientific Atlantists, pseudoscientific Atlantists, and occult Atlantists. Of the first, many seek an ancient culture that could have inspired Plato, without necessarily implying an Atlantic island that sank. In 1679, Olof Rudbeck "found" Atlantis in Sweden, and since then it has been "found" in Tunisia, Nigeria, South Africa, Ceylon, and elsewhere. We are embarrassed by a multitude of theories, many of which *might* be cor-

▼ HOW GEOLOGISTS believe the world may have looked about 100 million years ago, early in the Cretaceous Period, when Gondwanaland had probably begun to break up. However, changes as extensive as the ones indicated here all occurred long before man came on the scene. The large island west of Spain is the nearest thing to Plato's Atlantis, but most geologists believe it sank 15 million years or more before the most primitive man appeared on earth. And even the very ancient continent of Gondwanaland is not a scientific certainty

After Schuchert, 1916

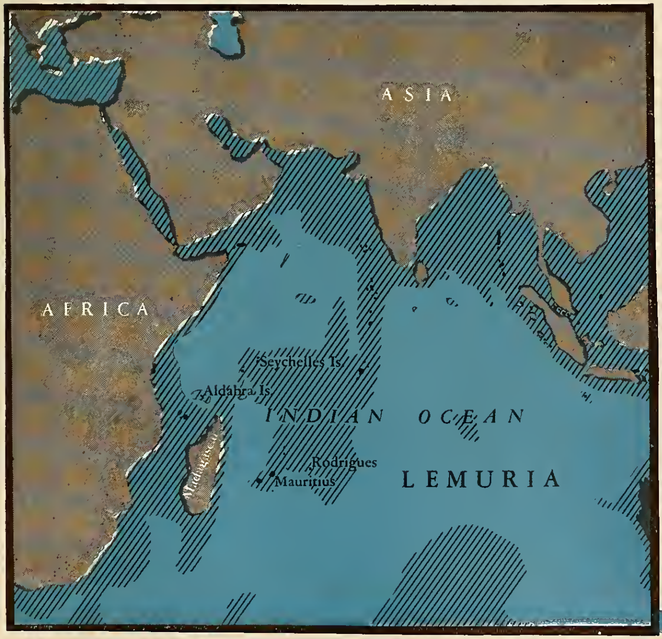


rect; but they can hardly all be true at once. The leading localities contending for the honor of being the proto-Atlantis are Minoan Crete and Tartessos.

The resemblances between Crete and Atlantis include sea power, imperialism, public works, and the ceremonial use of bulls. Tartessos, the Biblical Tarshish, was a flourishing city-state in southwestern Spain, the affinities of whose people are not known. About 500 B.C. the Carthaginian admiral Hamilco went out there with a fleet. He returned with a cock-and-bull story, adopted by Plato, about impassable shoals west of the Pillars. This now looks like Carthaginian propaganda to discourage commercial competition in those parts. Thereafter nothing is heard of Tartessos, and Hamilco is suspected of having liquidated this particular competitor in the course of his expedition. Tartessos suggests Atlantis by its location, wealth, and mysterious disappearance. There are resemblances between Atlantis and Tartessos on one hand and Scheria, the land of the Phaeacians in Homer's *Odyssey*, on the other. Connections between real Crete and Tartessos and literary Atlantis and Scheria are possible; we shall probably never know to what extent Homer, or Plato, or both, got their ideas from Crete, or Tartessos, or both.

Another approach is that of the English zoologist H. E. Forrest, whose *The Atlantean Continent* submits a North Atlantic land bridge taking in Iceland. There probably has been such a bridge in geological times. But Forrest wants his bridge in the Pleistocene period, which only ended quite recently, and his arguments, largely based on distribution of species, turn and rend him. He relies on plants, arthropods, and fresh-water fish, which are slowly-evolving organisms, some of which may have been about what and where they are since the Mesozoic period, some 60 million years ago.

▼ In about 1875 scientists suggested this ancient land bridge connecting Madagascar with Africa and India. A drop of 4000 meters in the relative level of the sea would produce it. It was offered as an explanation for the distribution of the lemurs and other relatives of the monkeys, and thus got the name Lemuria. But authorities do not now consider this lost continent a scientific necessity



For tracing the opening and closing of land bridges, the distribution of the large land animals offers the best evidence, because these creatures move about rapidly on land but cannot cross wide stretches of water by flying or swimming or floating as seeds or riding on driftwood. This sort of evidence and the facts of geology indicate a definite bridge in the Pleistocene era connecting Siberia and Alaska, but none between Labrador and Europe.

A similar objection is fatal to one of the two Pacific continents proposed by the Scottish mythologist Lewis Spence. He has a continent stretching east-west from the Hawaiian Islands to the Malay Archipelago. This ignores one of the sharpest faunal boundaries on earth, the line through Celebes and Timor that separates the animals of the Orient from those of the Australian region. As you go from Borneo to New Guinea you pass in two short steps from the Indo-Malayan world of monkeys, cats, buffaloes, and elephants to the vastly different Australasian world of kangaroos and echidnas. The only placental mammals that have reached New Guinea are dogs and pigs which could have been brought by men and probably were, small rodents that could have come by the driftwood ferry, and bats that could have flown. These facts indicate that the water-barrier of the Celebes, Banda, and Timor Seas and their connecting straits has been where it is for a long time, probably for more than 50 million years.

Then we have pseudoscientific Atlantists like Augustus Le Plongeon, who spent many years among the Mayan ruins of Yucatán. Dr. Le Plongeon was an expert in his way, but was as ready to fit the facts to the theory as Donnelly. He considered the Egyptian hieroglyphics similar to the Mayan and claimed to be able to read the latter, using a modification of Brasseur de Bourbourg's modification of de Landa's alphabet. Sad to say, people who tried to decipher

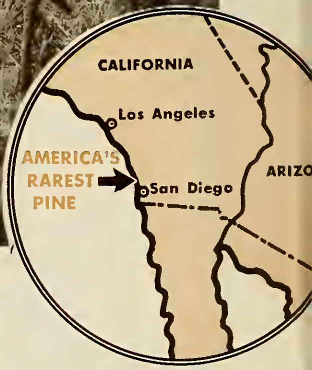
Continued on page 240

AMERICA'S *Rarest Pine*

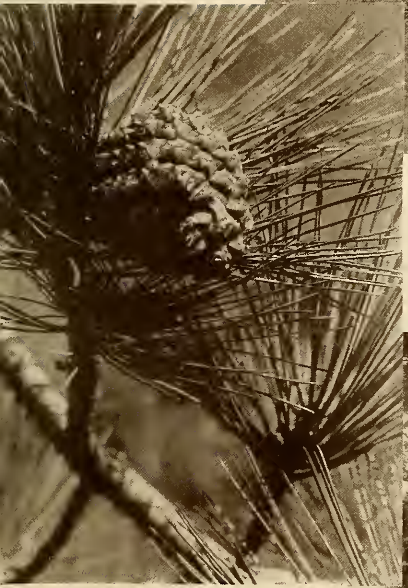
Its picturesque silhouette against the southern California sky makes a lasting impression on those who have visited the Torrey Pine's tiny domain

By GLADYS DIESING

▲ CONSTANT OCEAN WINDS sweep along Torrey Pine Mesa in southern California, helping to give the pines their twisted form


CALIFORNIA
Los Angeles
AMERICA'S RAREST PINE
San Diego
ARIZO

▲ **Amazingly small range.** The Torrey Pine is restricted on the North American continent to a strip of land about two miles long and eight miles wide near the northern edge of San Diego. It also grows on Santa Rosa Island off the California coast and has been planted in San Diego and New Zealand



▲ **The needles** are half a foot long and grow in clusters of five. The cone we see above was photographed while still green and measured four inches in length. The larger seeds, which develop in the cone, are gathered and eaten raw or roasted

▲ **The trees** are usually 20 to 40 feet high but sometimes reach 60 feet. Their light, coarse-grained wood is little in demand

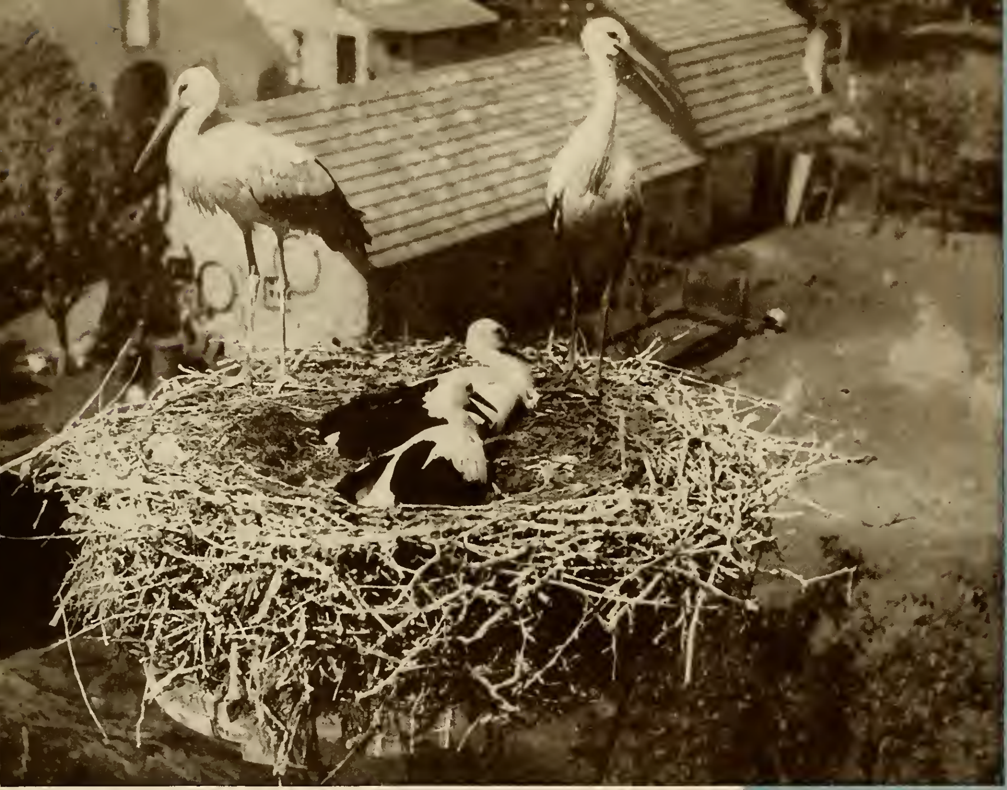


Photo courtesy of The National Association of Audubon Societies

▲ THE STORK FAMILY—male, female, and two young ones—pose for a picture

The Stork

The saga of a much talked about bird—sacred to some and cherished by nearly all peoples

By RUTH ELWONGER

WE are used to seeing him race with screaming ambulances and police escorts. He is the motif of countless baby showers. He is the glamour bird of advertising, and his picture appears on billboards, in streetcars, in newspapers and magazines. Consequently, almost everyone is familiar with the snowy plumage, the bright red bill and legs, and the characteristic one-legged stance of the White Stork.

In spite of this flourishing life in the public eye, few people in this country have ever actually seen him. In Europe you may see him raising a family on the rooftop, and he winters in South Africa. But in the United States, the shy Wood Ibis of our southern coast, a distant relative, is the only member of the stork family. The stork has close relatives in other parts of the world, although some of these would hardly be recognized as such. For instance, there is the Marabou Stork of tropical Africa, a gaunt gray bird with a dangling neck pouch and a bald head and neck, who functions as the scavenger and street cleaner of native villages.

The most unusual thing about the White Stork is the degree to which —unwisely it would seem—he has thrown in his lot with man. For ages longer than recorded history he has built his nest on a roof, in an unused chimney, or on a cart wheel placed on a pole for his convenience. Sometimes he builds in trees but seldom far from human habitation. Many peoples have held him sacred. By nearly all he has been unmolested and petted. In folklore he is the bringer of good luck to the household on whose roof he settles. The story that he is also the bringer of babies is of uncertain though recent origin, as legends go. Most probably, as someone has suggested, this idea was simply the inspiration of some harassed parent.

The stork's high qualities as a family bird have endeared him to man. From the moment of his arrival in the spring until the day his young are ready to leave the nest the stork concerns himself with

the repair and upkeep of the nest. His love for his home seems to be in direct proportion to its size, for he continues to add to it even after it has become enormous. One nest on a huge wagon wheel in Holland measured 12 feet across the top when it was finally blown down in a windstorm after 52 years of continuous use.

When the birds return to the north in March or April, the pair at once begins to toil on the nest. Brushwood is brought for the exterior; dry stalks and twigs for the interior; and moss, straw, soft grass—impartially even a clump of horse dung—for upholstering. One bird works up the material that the other drags home. But so great is the stork's attachment to his nest that early in the season even the mate returning to the nest after a brief absence is apt to be greeted with defensive postures and behavior. By the time the first egg is laid, however, these momentary lapses of memory no longer occur.

Courtship consists chiefly of the two birds facing each other with heads far back and noisily clapping together their long red bills. The stork is without voice or song, but this clappering, variable only in intensity and tempo, apparently serves adequately to express inner feelings, for eventually three to five white eggs appear in the nest.

It has been the belief of many people that storks mate for life. Actually, the perils of the long migratory journey are so great that often one of the pair fails to return to the nesting area. In such a case, the survivor must, of course, take a new mate.

Both birds share equally the arduous task of incubating the eggs continuously for a month. When one of them arrives to take over, the relieved partner does not fly away immediately to his frog-rich marsh or swamp to feed, but remains for a time beside the nest, clappering and preening. At night the female sits on the nest, and the male sleeps near by in the familiar stiltlike posture. Neither bird ever goes far from the nest. When danger threatens, the absent mate appears as if from nowhere. A complication of this idyllic homelife is the presence of "bachelor birds" who roam the countryside. These unmated or immature birds of both sexes, occasionally attempt to drive the owners away from their nest. Spectacular stork battles ensue, which may last all night, or even all week. The reason is by no means clear, for this is known to occur where there is no shortage of nests.

When the young finally hatch, the parents enter upon three months of unceasing labor. Feeding goes on without let-up from earliest dawn to dark. Until the young are several weeks old, only one parent leaves the nest at a time to search near-by meadows and stream borders for frogs, mice, insects, reptiles, small fish, crabs, and worms. These are carried in the crop to the nest and regurgitated in the center of the circle of voracious young ones. No matter how hard the parents work, there is seldom enough food to completely satisfy all appetites. Occasionally the last-hatched young is unable to compete successfully with his older brothers and sisters and eventually dies. There may possibly be some connection between this not infrequent occurrence and the last part of an old belief that storks leave rent in payment for a nest site—a feather the first year, an egg the second, and a young bird the third.

Natural ups and downs in the stork population might, if viewed too narrowly, give an unnecessarily pessimistic impression of the bird's future. Actually the stork was more abundant in certain sections of Northern Germany around 1935-1937 than in any other period in history. And it has spread greatly in Russia during the past 50 years. In other sections, for example Switzerland, the storks have not recovered from the low of the cycle

➤ STRAINED AND AWKWARD poses such as this are characteristic of the stork's mating ceremony

Photo by Morean

Photos by Morean

COURTSHIP OVERTURES without vocal companiment. Though voiceless, storks press themselves loudly to each other clapping their bills

that occurred about 1905-1925.

The parent on guard during these first few days not only keeps an eye out for danger but protects the young from too much heat by standing on the sunny side of the eyrie with wings spread. The inadequately garbed chicks accurately fit themselves into the shadow thus thrown across the nest.

Not until they are a month old do the young birds master the art of balance. Up until that time they awkwardly hitch themselves about the nest on their "heels." Facility in standing seems to develop in connection with the young birds' habit from the first of repairing to the edge of the nest to answer the call of nature, where, face to the wind, they teeter precariously. This habit, incidentally, keeps the nest clean, but the same cannot be said of the roof below.

More and more time is spent in wing exercises, but it is not until the third month that the wing feathers are sufficiently developed to permit real progress toward flight. Then the young birds soon gain enough skill to leave the nest for neighboring marshes and meadows. For several weeks more, however, they continue to return to the old homestead to spend the night and beg food from their parents.

By the end of August—when flocks of small migrating birds have already begun to dot the telegraph wires—the nest is finally deserted for the year. Soon after, the storks from all round the area begin to gather in a brown stubble-field. These annual reunions, at which each new arrival is greeted with much clappering, constitute the celebrated "Councils of the Storks." Here, according to legend, the date and hour of departure is set, and those unfit to travel are killed!

The itinerary of the storks of Central and Eastern Europe has been well plotted through the recovery of banded birds. The flock flies southeast over the Balkans, growing larger as small groups from other areas join it. It crosses the Bosporus into Asia Minor and skirts the eastern Mediterranean, finally crossing into Egypt by way of the Isthmus of Suez. The birds follow the Nile to its headwaters and pass Lake Victoria and Lake Tanganyika. By December they have reached their destination, the southeastern tip of Africa,—a 6000-mile journey. Their rate of flight is about 125 miles a day. Wherever there is plenty of food—a mouse plague in the valley of the Danube or a locust infestation along the Nile—the flock rests and feeds for a day or two.

Storks from western Europe and North Africa doubtless cross the Sahara on their way south. A few White Storks are believed to winter in Nigeria and Cameroun, but the vast majority go south of the equator. Numbers of them reach the Union of South Africa.

In South Africa the European White Stork is called the Greater Locust Bird. Here, free from the responsibilities of family life, he wanders about in small groups and fattens on locusts and caterpillars. But his vacation soon comes to an end, and by February he sets out again for the long return trip, unless he is one of the few stragglers who choose to remain in the South. Northward flight is even more rapid than that of autumn. It is as if the storks were in haste to reach their northern home and raise a family.

Two thousand years ago people fell on their knees at the return of this wanderer, who meant to them the end of winter's cold and hardship. As late as the eighteenth century, watchmen on the town walls announced the arrival of the first stork of the year with a blast of the trumpet.

◂ MAJESTIC PINIONS carry a female stork off the nest in the never ending search for food. The spread is about six feet from tip to tip

The BARREL-BELLIED Tree of Brazil

By Robert W. Schery
Missouri Botanical Garden, St. Louis, Mo.

THE semiarid world of northeastern Brazil, known as the *sertão*, stands in marked contrast to the jungle-blanketed Amazon country or resplendent Rio de Janeiro. The paucity and scrubbiness of vegetation there form a striking natural background for the Brazilian *barriguda,* perhaps the most singular floral element anywhere in that historic and picturesque region. Local banditry has waxed and waned, generations have lived and died, droughts have passed, leaving their trail of starved cattle, but the imposing *barriguda* has lived on above all the tenacious struggle for life in the inhospitable *sertão.*

Perhaps the enormous swollen trunk of the *barriguda* conserves moisture for the plant from the rainy seasons—lush times in the *sertão*—to help withstand the tribulations of the dry season and the periodic, ever-threatening droughts. In any event, dominating the landscape and dwarfing the scrubby vegetation, the *barriguda* would seem the epitome of stalwart resistance to time, adverse fate, and the unceasing attrition of a harsh environment. In the ebb and flow of such existence, man and beast may perish and smaller plants may wither, but the *barriguda* ever stands solemnly by, awaiting the eventual coming of the rains.

To the botanist the *barriguda* is *Cavanillesia arborea* Schumann, a tree of the picturesque and commercially important Bombacaceae family. In southern Brazil the name *barriguda* likewise refers to species of *Chorisia* and sometimes *Ceiba,* trees of the same family having an appearance somewhat similar to the *barriguda* of the *sertão.*

The name *barriguda* comes from the Portuguese word *barriga,* and can be translated literally "big-bellied" or "barrel-bellied." One of the most popular dance songs of the Brazilian Carnival of 1944 was *Club dos Barrigudos,* referring not to trees but to a hypothetical club of very obese individuals (the *Barrigudos*), which might well be imagined as resembling a desert stand of *barrigudas* holding solemn council in the sparsely populated Bahian *caatinga.*

These trees are most imposing during the dry season, when all vegetation loses its foliage and appears similar to North American deciduous scrub in winter. During these dry months, roughly corresponding to summer and autumn in the northern hemisphere, the enormous swollen trunks of the *barriguda* are spectrally visible through the myriad naked branches of *caatinga* brush. Large golden-brown winged fruits add to the effect—as if the enormous "ninepin" trunk were insufficient to attract the notice of a passer-by. These fruits look like delicately designed paper ornaments strung from the tips of the laxly spreading crown branches.

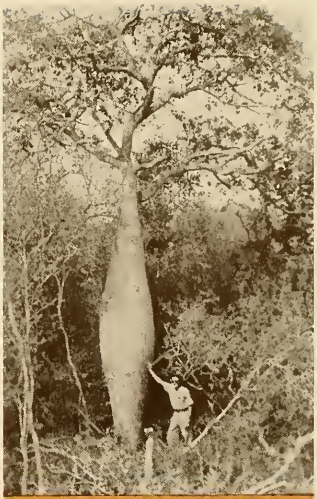
Earlier in the year, perhaps during April, one may be fortunate enough to encounter a *barriguda* in full flower. The overwhelming magnificence of the massed pinkish flowers, caught in a sunset against the then green *caatinga,* is sufficient to transport figuratively one familiar with the usually stark *sertão* into an unreal world.

The *barriguda,* fortunately for the tree, has little or no commercial importance. The wood is very soft, weak, and light, and is probably useful only in the making of paper pulp, an industry unknown to the *sertão.* Were the wood of importance, the *barriguda* could hardly exist in such an area, where wood is at a premium and where the residents, in their marginal existence, are anything but conservation-minded. In southern Brazil, however, the other types of *barriguda* have been reported to be of value in the making of canoes and for a kapok-like floss taken from the fruit.

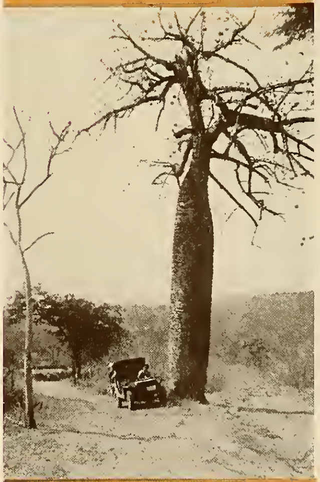
A close relative of the *barriguda* is the kapok tree itself (*Ceiba pentandra*), commercially important for the kapok fiber obtained from its fruit and used as a filling for lifesaving equipment and as insulating material.

Another close relative is the important balsa-wood tree (*Ochroma*), source of the lightest commercially important wood known. Thousands of American school boys are familiar with balsa-wood as the material from which they fashion their model airplanes.

But of all the interesting and important plants of the Bombacaceae, the *barriguda* remains the most picturesque because of its unusual appearance in its striking environment.



One of the world's strangest looking trees: a *barriguda* in leaf at the beginning of the dry season in northwestern Bahia



In fruit in mid-dry-season. The tree's grotesque silhouette gives a weird aspect to the landscape. Their domain is a semiarid section of Brazil that contrasts strongly with the Amazon jungle

Stories of the Australian Sky

◄THE OLD TRIBAL LEADER, Komita, representative of a people who have developed a culture rich in philosophy and ceremonial, though poor in material possessions

By CHARLES P. MOUNTFORD

With photographs by the author

THE beauty of the firmament has always fascinated me. Hundreds of nights have I lain under the desert skies and marveled at the glittering worlds above me.

But, although in the early days my wonder and admiration were unbounded, they were backed by little knowledge until the aborigines told me their stories of the night sky. True, I could recognize Orion, the Pleiades, Scorpius, and, of course, the Southern Cross, but the constellations of Argo, Delphinus, Eridanus, and many others were beyond my comprehension.

My knowledge of the star groups still has many gaps in it, far larger than I like to admit, but the necessity of having to improve my astronomical background in order to understand the aboriginal stories of their constellations, has increased tenfold.

Even now, I do not know enough to exhaust their fund of stories. Perhaps, one of these days, an astronomer will visit my brown-skinned companions and plumb the depths of their sky legends.

But I have gathered astronomical stories from all parts of the sky: stories about the Milky Way; the planets, Venus and Jupiter, known as the hunter and his dog, sometimes the one in front, sometimes the other; Sirius, and many others. Some are more or less complete, others mere fragments, but together they are sufficient to indicate the rich field that awaits the ethno-astronomer.

I know of only one aboriginal love story, such as fills our literature to repletion, and that is associated with a group of stars in the tail of Scorpius. The complete legend belongs to the secret initiatory rituals of the men; the women are told an entirely fictitious version.

In "dreaming time"—as the aborigines poetically refer to the period when the earth and the sky were being created—there lived a young boy and girl who were much attached to each other. This lad, in common with all youths of about sixteen, was banished from all contact with women for some years and during that time had to undergo a painful initiation ritual that would admit him to tribal manhood.

When his initiation drew near, the girl was most distressed, for she had heard vague stories from the women about the suffering that her playmate would have to endure.

So, when the ceremonies were reaching their climax, and the women were told to leave, the young girl broke the strictest of all aboriginal laws, crept behind a rock and, under cover of darkness, watched the entire proceedings.

Then she saw her playmate and one of the old men go to a separate camp to rest. The guardian, tired out with the long rituals, was soon asleep, but not so the youth, because of the pain from the newly inflicted wounds.

Distraught over what she had seen, the pain that her playmate was suffering, and the thought of the long time that they would be separated, the girl planned to take him away from the old men. Creeping up close, she attracted his attention with the cry of a small animal, then persuaded him by signs to come with her. But no sooner were the couple together than the guardian woke to replenish the fire. The girl, knowing that death awaited them if they stayed on earth (for both had committed an unforgivable sin), took the youth into her arms and "flew" into the sky.

The guardian soon realized that his charge had gone. He called his younger brother, and together they searched the ground for tracks. In a short time they knew what had happened, and looking upward, saw the fugitives traveling rapidly across the Milky Way. The brothers attempted to climb into the southern sky in pursuit. For a while, their feet kept slipping back (that is why there are so many more stars in the southern sky). However, they finally succeeded and strode along the Milky Way with great steps (paired stars across the sky are now their footprints), until they were close to the escaping lovers. A boomerang from the younger brother just missed the girl, but a throwing stick wielded by the elder, struck the boy's head and knocked the *pukati* (head-dress) from his head.

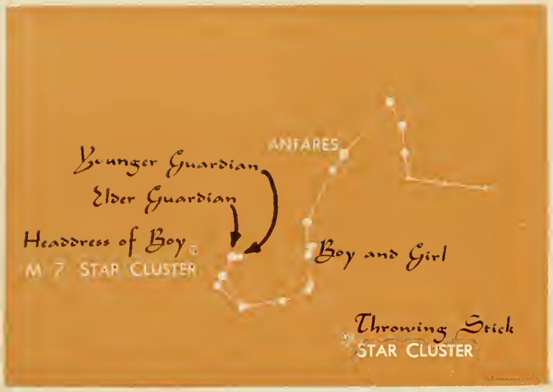
Now they are all turned to stars, the two guardians, the initiate, and the foolish and faithful girl—stars that tell the story to those who know, all in an aboriginal constellation around the tail of Scorpius.

The second magnitude star in the tail of Scorpius (Shaula) is the elder of the guardians; the adjacent star, the younger; the double star, the boy and girl, still close together. The cluster, M7, is the head-dress knocked from the head of the youth, whilst the throwing stick is transformed into another cluster, probably Gould's 1088. Some of the adjacent stars represent the boomerang of the younger brother and the girl's digging stick, but which ones I am not certain.

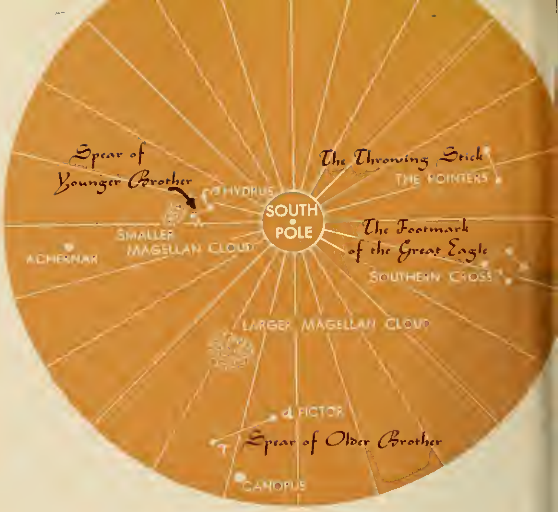
Another sky story that has a wide distribution belongs to the constellations of Orion and the Pleiades. Many nations have stories about the Pleiades, and the majority refer to them as "the women" (we call them the "Seven Sisters"). Orion, on the other hand, is usually a man and as often as not a very undesirable person.

The same idea exists among the aborigines of the desert; Orion is to them an evil fellow, Nirunya, forever chasing the Kunkarunkara

Beneath the glistening dome of night the natives of the Australian wilderness tell dramatic legends of the people who live in the heavens


ANTARES
Younger Guardian
Elder Guardian
Headdress of Boy
M 7 STAR CLUSTER
Boy and Girl
Throwing Stick
STAR CLUSTER

▲ A young boy and girl who violated the sacred rules of the tribe and were pursued into the heavens helped to originate the constellation of Scorpius, according to the aborigines of the Australian desert


Spear of Younger Brother
HYDRUS
SOUTH POLE
The Throwing Stick
THE POINTERS
SMALLER MAGELLAN CLOUD
ACHERNAR
The Footmark of the Great Eagle
SOUTHERN CROSS
LARGER MAGELLAN CLOUD
PICTOR
Spear of Older Brother
CANOPUS

▲ The Larger and Smaller Magellanic Clouds are the home of two brothers—one vengeful, the other kindly—who judge the dead, according to Australian legend

(the Pleiades). Again and again the women come to earth to escape his unwelcome attentions, but always they are discovered and have to flee.

Usually, the Kunkarunkara are too clever for Nirunya, and he is outwitted. But now and again he wins, and one of them falls a victim to his evil designs. A great many of the topographical features of the countryside in the Central Australian deserts were created, according to aboriginal legend, during the various encounters between the Kunkarunkara and the evil Nirunya.

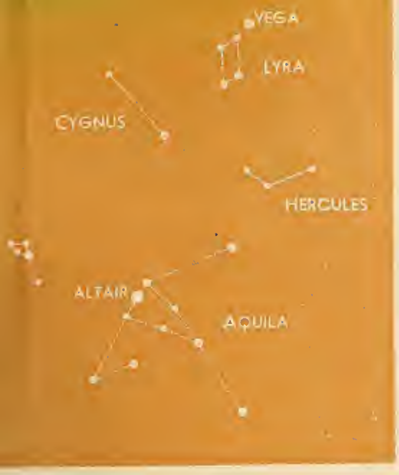
The aborigines showed me one place, where, during the early days of the world, the star women came to earth to gather food. "Here they made their camp," the natives told me, pointing to the hollows in the rock, where two of the star women had slept, "and early next morning, they started to dig for tubers in the ground. But Nirunya, the man of Orion, had seen them from his sky home; and when he thought they were engrossed with their tasks, he rushed after them from the shelter of a mulga tree [*Acacia* sp.]. But the women, seeing him coming, went underground for a short distance, then burst out and escaped into the sky."

The marks of the encounter are there today, the sleeping place, the pit where the sky women pushed their way through the ground and, on a flat rock surface, a hole dug by them in their search for food. Even lying against one of these holes is a block of stone, the transformed carrying dish left behind by one of the women in her headlong flight.

Another legend, associated with the Magellanic Clouds, Achernar, and Canopus, forms a basis of the belief in the reward for good and punishment for evil. Two sky beings, the Kungara, live in the Magellanic Clouds, the larger "cloud"

▼ A curious rock formation explained in Australian legend. This is where one of the women of the Pleiades, fleeing from the evil fellow, Nirunya (Orion), dug a hole in the ground and left her carry dish

▼ This is the hole through which the women of the Pleiades, after traveling underground, fled from the earth and escaped into the sky



THE MYTHICAL CROW PEOPLE, important in
spiritual philosophy of the Australian abo-
ines, occupy this portion of the firmament

being the home of the elder, the smaller that of the younger. Both have death-dealing spears, identified as the stars Alpha and Gamma Pictoris and Beta and Lambda Hydria, respectively.

When an aborigine is about to die, the younger of these sky beings takes his spear and goes to earth to capture the *Kuran* or spirit of the dead man as soon as it leaves the body, so that he can take it to his fire, the star Achernar, to cook and eat it. But the elder Kungara, a much kindlier fellow, whose camp fire is Canopus, will, if the dying man has led a good life, prevent his brother from carrying out his evil intentions. If, on the other hand, the sick man has been evil, untruthful or malicious, the elder man makes no effort to prevent the younger from carrying out his gruesome plans.

One of the aborigines made a painting of another constellation that includes all the stars of Delphinus, Lyra, Aquila, and parts of Cygnus and Hercules. This constellation depicts a family of mythical Crow people. (The Australian crow is similar to the American raven.)

Vega, in Lyra, is the mother crow, watching her son (Altair in Aquila) showing off his new decorations, bunches of special feathers on the tip of either wing. These are the third magnitude star on one side and the fourth magnitude star on the other. The father crow, seated by a waterhole and surrounded by pieces of meat that he has cooked, forms the constellation of Delphinus, whilst the remaining stars in Lyra, Aquila, and the arm of Hercules, along with Albireo in Cygnus, are either the footprints of the family or pieces of cooked meat.

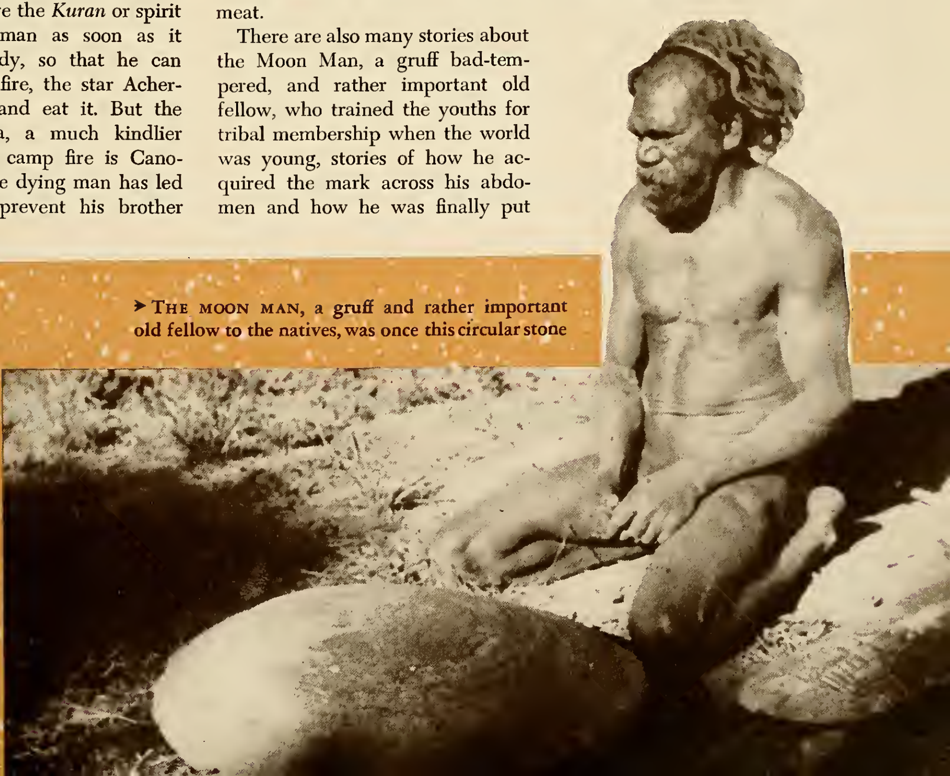
There are also many stories about the Moon Man, a gruff bad-tempered, and rather important old fellow, who trained the youths for tribal membership when the world was young, stories of how he acquired the mark across his abdomen and how he was finally put into the sky—so that he could not trouble the world again.

Another sky legend explains how the women of the Pleiades allow the frost to fall from their bodies during the early winter mornings, freeze the waterholes, and make the boys and girls grow to be healthy men and women.

There are many other delightful stories about the sky people in every part of the firmament: the Milky Way, the Coal Sack (that black patch in the southern sky), the Southern Cross, the Pointers, the False Cross in Argo, and many others.

Many of the mythological beings that made the world in "creation times" have been changed into stars that are not interested in the world below, but others of the sky people still wield a power, for good or for ill, in the affairs of man.

The aboriginal legends of the stars are not for entertainment. They are a vital part of the aborigine's culture, and to hear them told in the quiet of the desert night, beneath the glistening dome of heaven, is a vivid and unforgetable experience.



➤ **THE MOON MAN**, a gruff and rather important old fellow to the natives, was once this circular stone

We're HAUNTED by a Ghost Crab

Getting results from the study of crab habits can become quite complicated—especially when the experiment is brought into the home

By Lorus J. Milne
With the assistance of
Margery J. Milne

All photographs by Lorus J. Milne except when otherwise credited

Photograph by Edwin Way Teale

IT all began innocently enough The weather had been very hot, and both the laboratory by day and the apartment at night pressed the heat upon us as we struggled to get through the work that had to be done. By Saturday we were ready and away in the car. We decided to visit Cape May, where the beach had been described to us as "perfectly clean." It sounded like just the place in which to relax, swim, and forget the war, physics, and biology for 24 hours. It might even be cooler! We could leave all our cares behind us and find no new interests to make demands on future time. All we could possibly bring home from a really clean beach would be a sunburn and perhaps some mosquito bites. It was an ideal week-end plan, in theory.

We even had a place to spend the night. One of our students had extended an invitation from fond and unsuspecting parents to stay with them whenever we could get to Townsend's Inlet. They greeted us there with enthusiasm and urged us to don swim clothes at once and enjoy the ocean while the sun was still bright. But in the "perfectly clean beach" were numbers of oblique holes two inches in diameter. Into most of them led unusual animal tracks. Without the slightest warning, our peaceful week-end tottered and fell. Duties to friends, resolutions against new problems, the sun, the sea—all were forgotten. We *had to* know what had made the footprints and inhabited those burrows!

Pulling away the damp sand in large handfuls, it was easy to follow a tunnel slanting downward for over a foot, then curving gradually to extend horizontally. There was even a second passageway to the beach surface, a side door so to speak, communicating with the first part of the main tunnel. Oddly enough there were no tracks from this opening. It must have been constructed from within. But where did the burrow go, and what had dug it! Out came more sand.

Suddenly something large, pale, and ghostlike, shot out of the excavation. Just a few inches in front of my nose as I knelt on the beach, stood the evicted owner of the burrow, glaring at me with a pair of brown eyes set on the ends of upright stalks. Very erect on his eight bowed legs, the yellowish-gray crab waved his pincers at a threatening angle and jiggled his cubical body up and down several times a second. His legs, all fringed with golden hair, curved in graceful arcs so that the creature rested on the backs of his inturned claws. We froze, and the crab lowered his guard a little, then dropped his eyes momentarily while he wiped them clean of sand with his mouthparts. Still no action from us. Off went the crab on the run, sidewise in the best crab tradition.

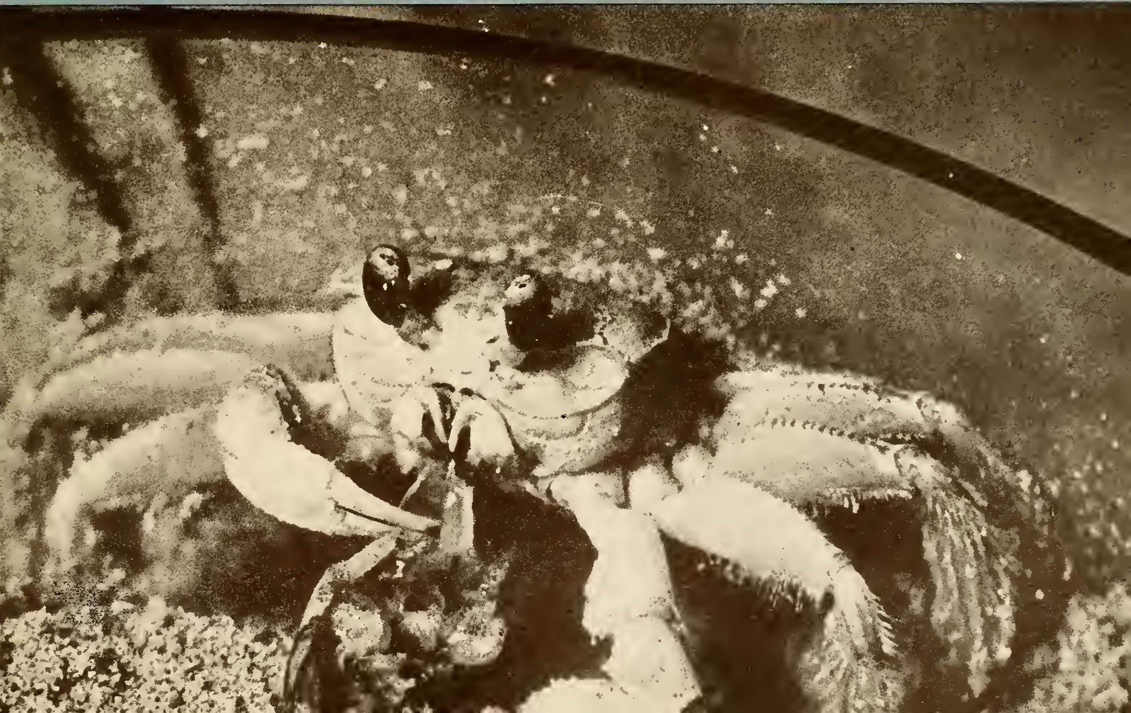
We had "frozen" to watch the crab under a cloudless sky on a hot day, and I was running rivulets of perspiration from the digging. We must not let the animal escape. After him we went—four and a half inch crab, five and a half foot girl, six and (almost) a half foot man! The creature led us quite a chase as we ran interference between him and open holes on the beach. Finally he turned at bay, prancing and daring us to come closer. With my fingers I flicked some sand at him. The crab jerked into a new position, exposing his undersurface to us while he reached into the air with his pincers, trying to find an attacker. More loose sand followed, and by the volume of the barrage the crab was finally covered so that only his waving nippers remained uncovered. Since the animal could not see, it was no great trick to seize a pincer in each hand, and lift the crab gently from the mound. Then down to the water's edge we went to wash the sand from him.

At first the crab kept his eyes in the protecting grooves that extended across the front top edge of his body. He struggled, but not excessively. He tried to catch us with his nippers but did not have much chance. One pincer was considerably larger than the other, with an expanded white palm to the imitation hand, and little teeth along both the opposed surfaces of the claw.

The captive crab had a pitiful, frightened appearance. I tried to make him more comfortable by supporting his walking legs also,

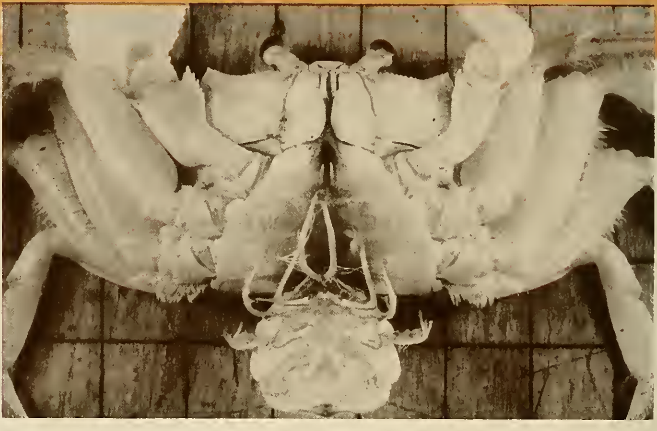
↓ The ghost crab is one of the most gifted of all the crustaceans, readily adapting himself to new and changed conditions. "Ghost" is an appropriate name for the animal because he has the ability to appear and disappear at a moment's notice. And in keeping with the habits of a ghost, he is most active at night

↗ Early in the morning, the ghost crab may be seen along the beach, bringing up armfuls of damp sand as he extends his burrow. Note the backdoor (*middle foreground*) excavated from inside the U-shaped tunnel. Later he will level off the pile of earth at the front door, and if the sun is hot or the wind drifting he will plug both openings with sand brought up from below. He spends his afternoons inside the burrow



WELL CAMOUFLAGED. When the sun pours
own on the dry sand, these crabs are a pale
eam color with few markings, but on the
et beach they change to speckled gray, pur-
le, and brown (*see above*) to match their
ckground

▼ **THE FEMALE GHOST CRAB** has a broad abdomen. Her swimmerets form supports for the greenish yellow eggs, which have a safe place to develop within the well-protected bend of the body. The squares are one-half inch on each side



and the animal responded at once. Up came his elongated eyestalks from their protective grooves. Abruptly the crab began blowing froth, extruding it between his white mouthparts in a foam of tiny bubbles, the popping of which was distinctly audible. Apparently he had become wetter than he liked while being rinsed in the sea and was getting rid of the extra water by blowing. This seemed a peculiar action for a crab, since all of the ones familiar to us were gill breathers, dependent on an adequate supply of water and capable of very little bubbling. How could a crab blow?

Margery became a crab-holder while I dug for another to see if they were all alike. The second crab was taken prisoner before it was quite uncovered in its ruined tunnel. Washed in the sea and alerted by support of its legs, it wiped its eyestalks with its mouthparts and proceded to blow bubbles just as had the first one. We caught several more and they were alike except for size. The smallest straddled less than two inches, the largest over nine.

Burdened with booty

There is a definite limit to the number of struggling crabs that two persons can hold at one time. Fully burdened, we returned to our friends' cottage to beg some jars or other containers. They showed less surprise than might have been expected; apparently college professors can get away with any kind of peculiar behavior! They provided us with an assortment of bottles and cans for our prizes and then let us leave the menagerie on the porch. After that we were ready for swimming.

When the mosquitoes drove us from the beach in the evening, crabs were beginning to appear in the mouths of their burrows. We decided to dose ourselves with repellent "dope" and return with a flashlight to see what activity the crabs showed after dark. Toward midnight we risked the mosquitoes again, and found that either the repellents or the raincoats we wore, were highly effective. The dry beach, where the burrows were, was almost devoid of crabs. But down on the damp sand where the high tide washed, numbers of crabs of all sizes were feeding. They paid little attention to the flashlight, so that we were able to walk up close and watch them. With delicate and precisely controlled movements of their pincers, they explored the wet beach within a few inches of the waves, to find and remove tiny particles. They lifted these to their mouths, manipulated them and chewed them thoroughly before swallowing. Females with greenish-yellow eggs glued within the protective bend of their bodies, waded out where the waves came over them and opened their brood pouches to wash the developing young in clean sea water.

Although it was well after midnight when we returned to the cottage, it was Saturday and our hosts were playing cards with other guests. Before going to bed, we inspected the captive crabs on the porch. One container was empty—a jar with a rusty top. The crab had forced its way out and was somewhere, free! Where? With our flashlight we hunted high and low on the porch. No crab! Should we tell our hosts and their non-naturalist guests? We hunted some more while the card game occupied their attention. Still no trace of the crab! Uneasily we decided to go to bed, to look for it early the next morning before our hosts were up, trusting to luck that the crab wouldn't draw itself to their notice beforehand.

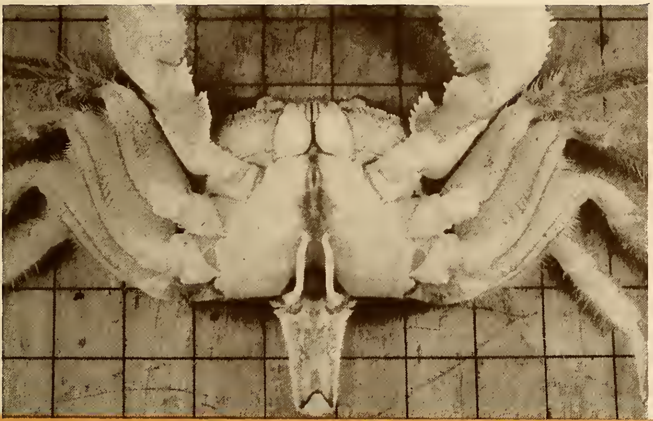
Our few hours of sleep were haunted by dreams of crabs and more crabs, the house full of crabs. Shortly after sunrise we tiptoed to the porch. There in the middle of the floor was a crab! Was it THE crab? Very quietly so as not to disturb our hosts, we caught it and looked for another container in which to cage it. To our amazement, we saw that all our bottles and cans had been shifted, and that a new tin had been added. The explanation was clear. The free crab must have met our hosts, been caught and incarcerated in the new can, and escaped again, all while we slept. But whispered discussion of it there at six in the morning in our present humor would not appeal to those who were still asleep. Our crabs must surely have us in the doghouse! We bottled the crab more securely and hurried out to the beach where we laughed until the tears came.

On the beach, crab tracks were everywhere, and great piles of still damp sand testified to recent digging in each burrow. By approaching quietly and waiting without moving a muscle for five minutes at a spot, we were able to watch crabs bringing up loads of earth, spreading it over the mounds or actually throwing it from the crest of the hills. Other crabs were intent on leveling the sand into a smooth fan-shaped area in front of the tunnel mouth, but whenever we moved, they hurried to the openings and disappeared from sight.

By ten o'clock we gathered up cameras, bottles, and courage to meet our hosts, and left the beach. We found them chatting with a distinguished looking neighbor as we arrived in bathing suits and sun glasses, arms full of paraphernalia. "I want you to meet Dr. Milne and Dr. Milne,"—the introduction which always brings first incredulity and then broad grins. Apparently our credit was still good! Who then had caught the crab? For a while after the neighbor left, no mention was made of the incident. Finally we could stand the suspense no longer and asked for the story. Amid gales of laughter in which all joined, we were given an account of the meeting of host and crab—both barefoot! —and of the chase, the hushed consultations. Should they wake us? Could they keep from doing so? All of the household except our soundly sleeping selves had joined in the pursuit of one medium-size crab, rocking with glee as they shifted furniture and tried to drive the wary animal into a corner. They had caught the crab but not until their sides ached from suppressed laughter. They lived it over again as they recounted the incident.

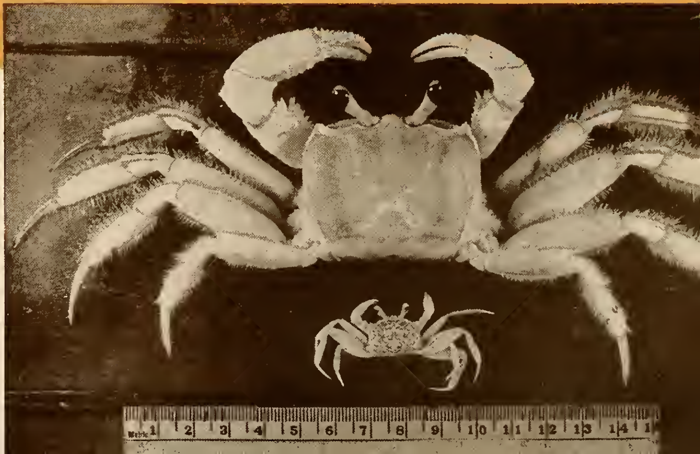
With a bit of the beach

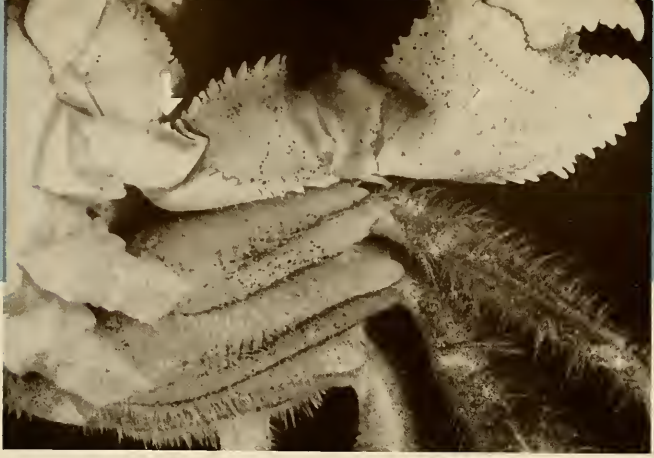
When we returned that night to our apartment, we wondered where our restful week-end had gone. Furthermore, we had our first vague doubts about the inspiration that had led us to bring home one live crab in a can, for "further observation." With it came a paper



▲ **The narrow abdomen** of the male ghost crab protects its claspers—organs modified for fertilizing the female's eggs

▼ **Ghost crabs** vary greatly in size, some being as much as nine inches across, and the tunnels are built in proportion. Small ghosts usually burrow nearer high tide mark, while large crabs may live in the dry dunes





◄ GHOST CRABS HAVE "VOICES!" A peep like that of a bird expresses alarm. A grating or buzzing sound means a warning and may be heard when a second crab tries to enter an occupied burrow. This is produced by rubbing the row of bumps on the palm of the large pincer (righthand arrow) against a sharp ridge (left-hand arrow)

sack full of clean, dry, beach sand, a quart of clear sea water, and a shallow dish containing living food for the crab—these were nursery impedimenta. We had in the house no container suitable for the crab and decided to leave it in its can for the night. The crab food—smaller crustaceans familiar to many as Hippa—were crowded into the refrigerator along with the salt water and, incidentally, our own food supply. We complimented ourselves on how little beach sand we had tracked into the apartment, gently washed our sunburns, and went wearily to bed.

Almost immediately it seemed (although the clock said two in the morning), a terrific bang brought us out of sound sleep with a jerk. The crab had rolled its tin to the edge of the table and come crashing to the floor. Off had come the lid, and the crab was free. The sand that had covered it was sprayed halfway across the room.

We soon caught the crab and returned it to its tin, placing a heavy book on top of the lid, although the crab looked even more tired than we. The sandy floor could wait until morning. Where now was the inspiration that had led us to bring this animal home?

At the laboratory the following day we obtained a better container, a glass dish to house the crab. But our friends there wanted to know why we looked so exhausted—it wasn't *that* hot today. Each of us explained that we had a *crab* in the apartment. Not until later did we realize that the sad expressions that clouded our friends' faces were due to their thinking, "How they must have fought with one another last night! A spouse can certainly be disagreeable at times."

The circular glass dish was placed on the small desk top. It was a foot in diameter and four inches deep. We filled it halfway with sand dampened with sea water, then put in the crab and clamped a cheesecloth cover over the top with rubber bands. Of course we would not be able to use the desk for days. But at least the crab would be more comfortable. Margery spent the evening cleaning the house and finally was satisfied that all of the sand spread by the crab the night before had been swept up and disposed of. We went to bed early to get a good night's sleep.

Noisy boarders

The next day dawned with the rattle of clawed feet on bare hardwood floors. The crab was exploring the apartment. Sand was everywhere! During the night the animal had churned completely the damp sand in its dish, throwing much of it out through the meshes of cheesecloth. A sizeable hole had been torn through the fabric and through it had come the crab, shedding sand at every step. There was a small pile on the floor, mute evidence of the crab's fall from the desk top. And to make matters worse, when we began pursuit, the crab kept racing from one radiator to another, climbing up into the tubing and (to our chagrin) becoming covered with fuzz, which it shed in place of sand whenever it dashed for a new hideout. Finally we caught the crab in a corner and, in spite of its pugnacity, got hold of its pincers as it was attempting to crawl up the wallpaper. Rinsed in our dwindling supply of sea water, the crab placidly blew bubbles at us again. This time its dish received a stronger cloth cover and more frequent inspection. The sand remained in our rugs.

By night the crab had become somewhat reconciled to its cage, and when uncovered, it posed nicely for some close-up photographs in the heat of a photoflood lamp. Indeed, it was only when the lamp was turned off that the crab jumped with fright, reminding us that crustaceans have a strong "off" response in their eyes. Prior to this it had accepted a drink of cold sea water when a pipette was brought gently to its mouthparts and the liquid extruded drop by drop. While taking the water, the crab made little waving gestures with its smaller pincer, but never attempted to seize the pipette. More exciting, it seized a beetle struggling in a forceps and, holding back the wings with its nippers, guided the insect's abdomen expertly into its mouth, using both claws with equal skill, sometimes one at a time, often both together. Occasionally it used the smaller pincer with great rapidity, transferring tiny morsels to the mouth one after another like a child eating peanuts from a dish. After accepting drink and food, the crab was more enterprising and began a series of runs to the side of the dish and over its rim, always finding there a human palm to convey it back to the center of the dish. The crab never made any attempts to pinch the hand that carried it or to use its nippers to supplement its hold. The sharp tips of its eight walking legs held tightly even when the crab clung underneath an inverted hand. It showed no fear but demonstrated awareness of even small movements of a supporting palm by compensatory movements of its upright eyestalks.

During the day, the crab had made a burrow in the churned sand of the dish,—a U-shaped tunnel with a good ramp at each end. We wanted if possible to see the animal at work digging. So while it was getting its exercise running out into our hands we smoothed the sand in the dish and packed it down.

Sure enough, the crab presently stood at one spot and began to dig its claws into the earth, using the four legs of the side bearing the smaller pincer. It pulled sand loose with these legs and shoved it back under its body, moving forward as the hole became deeper. It then began gathering sand in the hollow of its digging legs and using these as a basket, leaving the other four legs to do the crawling. Every time it went into the hole, it first lowered its entering eye into the protective groove, leaving the other one upright. As the crab went down obliquely farther and farther, the removal of sand required two steps. The first was as just described. In the second step the crab got behind the loose sand and used the larger pincer and to a small extent the walking legs on that side as a bulldozer blade to push the sand completely out of the burrow. As the crab warmed up to its work, the earth flew out of the passageway in spurts, and landed inches away. Now we could see how the sand had been spread over the desk top the previous night. It was there all over again!

Fortunately for us the crab had begun digging at the edge of the glass dish, so that as the burrow reached the bottom and progressed farther horizontally, we could watch the animal through the transparent walls. The process continued with only one major change in method. Originally the sand had been dug away only from below. Now the animal braced itself at various angles and dug a cylindrical burrow, larger than its body. Sometimes it would be face-up, sometimes face-down, or even completely inverted. The claws of the digging legs could be used in various directions on the sand at the end of the tunnel. They formed the irregular equivalent of a rotating sand scoop, and in a very few minutes had produced a tunnel several inches long.

Getting used to it

Night after night we have watched the crab, given it sea water, food, and exercise. On a few occasions it has been too quick for us and has fallen to the floor, to lead us a merry chase, with episodes of pitched battle, before being returned to its dish after a sea water rinse. Margery sweeps and dusts, but the apartment gets sandier and sandier!

The live Hippas we brought from the beach as food for the crab were a great success. Each is a plump inch or more long and lives in a layer of sand covered by half an inch of sea water in a shallow dish in the refrigerator. If dug out and released, they promptly bury themselves tailfirst. If handed to the crab in place of insects they provide oversized steaks for the larger crustacean. The crab eats until satiated, then drops the remains and digs in for the night, or carries the last few morsels into its burrow to consume them at leisure. We carefully rinse off rejected pieces of Hippa, decide whether they are large enough to be worth saving, and if so, wrap them carefully in wax paper and place them in our frozen food locker, to be thawed out next night for the crab. Everything but the sand is down to a system!

One evening when our captive crab was posing for photographs, several neighbors dropped in to bring us some other live animals they hoped we would find unusual. They stayed to watch the camera work, and Margery alternated between being a hostess and being a crab-tender. It was a hot night under the photofloods and her brief bathing suit seemed appropriate in our beachlike living room. We were somewhat concerned, however, when our guests wanted to help out by serving themselves. Limeade in one bottle and sea water in another were not distinguished too easily in the refrigerator. Then too, the crab got away and had to be caught and rinsed. The sink was full of ice cubes, and after the crab was back in its dish, the ice had to be washed free of salt water. Hospitality had its complications!

Much later, while one of us changed film in the camera and we rested a moment before getting ready for bed, the other picked up a *Reader's Digest* and read aloud, "A dull evening, ending with a walk to tire your muscles, is the best preparation for sleeping." How can one spend a dull evening or go for a walk either, when haunted by a ghost crab?

Our friends cannot understand how fond we have become of the crab. They listen politely when we claim that it adapts itself more quickly to new and changed conditions than do most animals, and quote Alcock (1902) that these are "the most gifted members of the whole crustacean class, and among arthropods, are inferior to none but the social insects." For we have looked up volume after volume in the libraries to see what has been written on the habits of our ghost crab.

The term "ghost" was applied to it by someone who knew it in the living state. Not only is the creature primarily noctural and possessed of a pale coloring which blends wonderfully during the day with

➤ Toward midnight ghost crabs go down to the ocean's edge. Females with eggs wade out and wash them thoroughly; the others merely moisten their breathing chambers with sea water, and feed on tiny particles

◄ INTERESTING PETS. Ghost crabs become used to handling, and their intelligent behavior provides much amusement

dry beach sand, but it has the uncanny ability to appear and disappear without a moment's notice. You may be resting on a quiet beach under an umbrella, when suddenly a ghost crab is 20 feet in front of you. None was there when you sat down. You did not see it approach. Ten seconds later it may be gone, and unless you watched carefully, you failed to see it drop into a small hole leading to its burrow. Or you may find one as you walk along quietly, and decide to follow it from 20 feet away. If the crab finds no tunnel opening but chances on a little hollow in the loose, dry sand, it vanishes in a few seconds even as you watch fascinated. With a few practiced movements of its legs, it sinks body and appendages into the beach until only its two brown stalked eyes remain above, to watch you as you pass it by.

As the day progresses, the ghost crabs retire to their burrows to remain there until evening. Although their tracks in the sand betray their presence on the beach, the position of the burrow opening is often concealed by the crab. A plug of earth is brought up from below, or formed at the tunnel mouth, expertly positioned so that the burrow opening seems nothing more than another depression in the beach, such as a footprint made by a larger animal. If there is sufficient wind to drift the sand a little, all trace of crabs, tracks, and plugged tunnel mouths vanish for the day. We were fooled this way the week-end we tried to find the northernmost extension of crab-inhabited beach.

A hundred and forty-four years ago, a French naturalist, M. Bosc, observed the ghost crab in great numbers on the coast of Carolina, and his account and illustrations were published in Paris in 1802. For 80 years no one added much to our knowledge of the animal, although books dealing with crabs referred to *Ocypoda quadrata* and informed you that it is one of the most intelligent of all crustaceans. Then an instructor at Johns Hopkins University, Dr. R. P. Cowles, enjoyed a stay at the laboratory of the Carnegie Institution of Washington on Loggerhead Key, in the Tortuga Islands off the southern tip of Florida. The ghost crab was particularly abundant there, and he became interested in its habits. His very informative report (1908) mentions that this is primarily a tropical and subtropical animal, apparently limited in its spread up the coast by the cold of winter weather. It has been found on Long Island, but only the immature stages have been taken off Martha's Vineyard and Cape Cod, to which they have apparently been carried by the Gulf Stream beyond the temperatures where they can establish themselves.

To the scientific literature we can add one positive statement. It is based on long and varied experience. We have kept caterpillars on the window sill, moth cocoons on the draperies, mantis eggs in the kitchen, fireflies in the bedroom, and live jellyfish in the refrigerator. We have had earthworms and grasshoppers hatch from our indoor window box, and burying beetles nurse their young in a covered pan, but never did any of these involve us in as many hectic happenings as have our ghost crabs. You can share a tent safely with a horned toad and keep an open dish of water-striders on the dinette table, but you can't keep a ghost crab where you want it unless you hold its hands,—both pincers, in fact.

➤ THIS CRAB is very much at home in the Milne's apartment. In a glass dish partly filled with damp sand, it has constructed a short and shallow U-shaped burrow into which it retreats when strangers appear

DARKNESS
To All Who Dwell There

By Frans Blom and Gertrude Duby

An expedition through the orchid bowers of Central America accents the ideal that no problem in human misery should be too remote to receive skillful ministration

On January 15, 1945, a small group of travelers left the town of Huixtla, in the State of Chiapas, Mexico, a railroad stop on the line that follows the Pacific coast toward the border between Mexico and Guatemala. A long and arduous trail lay ahead of them and, though they did not know it then, ahead of them also lay things of rare beauty and incredible horror.

The party was composed of José Parra, of Mexico, long recognized as an expert on the study of disease-carrying insects of different kinds; Gertrude Duby, recently known as an explorer among the Lacandon Indians of Mexico; Hector Arévalo, general handyman, who was hired as a mule-skinner and whose personality endeared him to the travelers; and Frans Blom, who loves to be in the saddle better than anything else.

After an hour's ride they reached the foothills of the Sierra Madre, and their quest had begun. The "Inter-American Indian Institute" (*Instituto Indigenista Inter-Americano*), of which Dr. Manuel Gamio is the director, had sent them out to study the migration routes of a terrible affliction that brings total blindness to its victims.

When Dr. Gamio called Miss Duby and Mr. Blom to his office and explained what they were to do, neither had ever heard of onchocerciasis, and it took them some time to learn to pronounce the tongue-twister. They picked up some information in Mexico City and more in Huixtla at the fine Mexican Government Hospital dedicated to the study of this disease. But it was only when Dr. Rudolf Nettle of Huixtla brought out his microscope and showed them the thousands of squirming microfilaria that wiggled through a minute piece of human skin, some of which had been on their way to the eyes of a human being, that they really realized the true importance of their investigation. This is the story of their journey.

It was a beautiful morning when at last we crossed the railroad track and climbed toward the continental divide. We were soft to the saddle and therefore went slowly. Soon we were traversing a zone infected by onchocerciasis. From the pass known as the "Cumbre del Pan," one glimpsed waves beating against the Pacific shore to the south; toward the north, mountain range was followed by mountain range, and very far away lay the Gulf of Mexico. From this point we dropped steeply to the town of Motozintla lying among barren mountains. We stayed there a few days and then went on, following the Cuilco River, which flows toward the Gulf. Early one day we reached Nuevo Amatenango and there made camp.

On the morning we left Nuevo Amatenango a breeze rustled among the banana leaves, and the air was filled with the perfume of orange blossoms. Our saddle and pack horses trotted briskly along the main trail that comes from the Pacific coast and carries you into the heart of that surprisingly beautiful state of Chiapas. We rode along this trail for about an hour and then turned away toward the east, following what looked more like a goat track than a route of travel. Our goal was Unión Fronteriza, a small settlement of Indians. What we heard about that place filled us with fear.

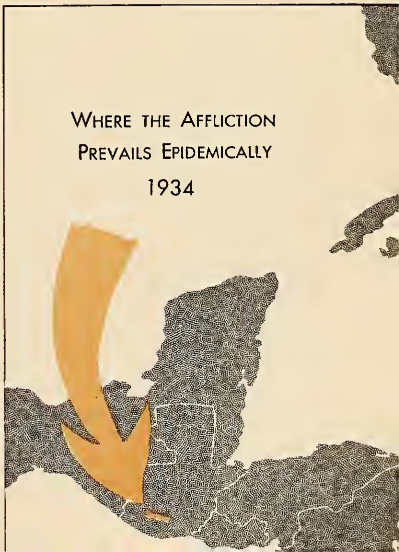
Following the narrow valley we soon began to climb its northern slope. As we ascended, the vegetation changed from the rich foliage of the tropical rain forest to scrub oak. Hardy and gnarled oaks twisted their branches to suit the prevailing winds. Their growing pains made the landscape look near-insane. Their twisted forms were at times indecent, and in the cup made by their branches clustered bunches of orchids. There were not many of them, but their flaming colors beckoned our attention. Some were purple, some were gualda (the orange of the royal Spanish flag), some were brick red. Their eye-insulting presence made us see them.

Again the soil changed, and with it the vegetation and the landscape. The trail was steep, and we worked our way wearily. At some places we had to dismount to ease the burden of our horses. Panting hard and with hearts throbbing, we came into a magnificent stand of pine trees. Tall and glorious trees raised their heads above us, casting their cool shadows on our trail. The orchids faded away, and we joked about their not liking the fragrance of the evergreens.

Up and up the trail we continued, looking uphill all the time. We kept thinking that now we would get to the top, but there was always another climb ahead. At last we reached the summit. Winds whispered caressingly among the pine needles, and we unstrapped our altimeters to record the very cold fact that we had reached the altitude and climate of 4000 feet.

We stopped for a short rest and looked down into the next valley. We could see the white spray of a mountain torrent very far below and could hear its rhythmic roar, sounding like the monotonous whir of an electric fan, going on for ever and ever. It was the Tapisalá River.

Then somebody said, "Look! There are the houses of Unión Fronteriza!" And through the maze of giant pines, we saw a cluster of houses. That was where we expected to pass the night.


WHERE THE AFFLICTION PREVAILS EPIDEMICALLY 1934

The downgrade was even steeper than the climb. On foot, skidding and slipping on the deep carpet of pine needles, we finally landed —mostly sitting—on the left bank of the Tapisalá River. A couple of planks made a bridge. Our select saddle and pack horses resented having to use that kind of a crossing. What we said to them during the next half hour would even make some of Hemingway's dialogues sound like baby talk.

At last we got across the little bridge and stopped for a rest and a cooling drink of clear mountain water. To our right and left, above our heads in the green foliage and silhouetted against the clear blue sky, were orchids, orchids, and—more orchids.

"I've read tall stories," said Blom, "by explorers who came quickly to Mexico and Central America and left even sooner to write a book, but I don't believe *any* of them ever saw *this*. Nobody has been to this valley to describe it, so it must be a lie, a hallucination, just bunk."

The Blom ramblings were cut short for a moment when Hector yelled that one of the horses had torn itself loose and was feeding contentedly on a cluster of purple orchids. When order was restored, Blom continued, "What's the use of writing about this? Printed letters are black scrawls on white paper and you can't put the purple magnificence of this sea of flowers into words. You have to see it to believe it."

Most of the party went to sleep, for it was the siesta hour, and the horses were getting a rich meal from the luxuriant grass growing at the river's edge. One of Hector's sleepy eyes opened, and he spotted a white orchid.

His cry woke the rest of us. We got it and saw more of the same kind. We collected them in the hope that some might blossom in the Cuernavaca garden of a friend of ours next year. We also gathered a lot of the purple orchids, which were so thick in the oaks that the trees looked like flowering bougainvillea. All of the orchids looked better than those you see in Fifth Avenue windows at $25.00 a flower—and our horses were eating them! Before long our hats and the headgear of our horses were decorated with enough blossoms to make any debutante or chorus girl green with envy. They smothered the trees like so many old weeds. And as we marveled at this exuberance, our hands moved restlessly around our heads to chase away thousands of annoying gnats, which assaulted us bloodthirstily.

We did not know it then, but an hour later our eyes were to see the people who could not see.

The trail now wound through plantations of oranges and lemons. Coffee bushes and bananas stood close to the road. Rich green cornfields were fenced with pineapples, and sugar cane waved in the wind. Houses began to appear, and gardens with papayas, melons, tomatoes, and tobacco. Here and there cattle and horses grazed; chickens and turkeys scratched for food in the village streets. Few places could be better endowed by nature with the things man can eat. It was a veritable land of milk and honey, of fruits and other foods.

Our cavalcade rode up to the *cabildo* or town hall, and we dismounted. Entering the main room, the municipal agent greeted us very kindly, and we handed him our credentials from the Governor of the State of Chiapas, Señor Juan Esponda. The agent began to read, seemingly with some difficulty. He read about half way through the letter, then suddenly sighed deeply and stopped abruptly. For a moment we thought he was unable to read, but then we realized what the matter was. He was a victim of the horrible disease called onchocerciasis.

This ghastly disease is caused by small flies belonging to the genus *Simulium*, commonly known as black flies. It is transmitted in the same way that the anopheles mosquito transmits malaria. The fly bites an infected person and carries the disease to one who is not infected. Specialists believe that at least three kinds of these flies are the criminals: S. *ochraceum* (said to be the worst), S. *metallicum*, and S. *callidum*. They bite during the daytime and live where there is running water. Coffee bushes grow between certain altitudes; they need rich soil, and running water is absolutely necessary for the treatment of the bean. This is the ideal situation for the flies, and where there are coffee plantations in this region there is danger of onchocerciasis. The flies may bite wherever the skin is exposed, as on the feet, hands, arms, or face. In biting a victim of the disease, the fly takes in, with the blood, varying numbers of microfilaria of *Onchocerca volvulus*. These undergo development in the fly, and after six days or more the fly is able to transmit the disease by its bite. It injects the rejuvenated organisms into the blood stream, where they develop into adult worms, the females from one to two inches long, the males half as much. The males and females are found together in the nodules in which the microfilaria develop and are carried in the blood stream to all parts of the body. Some of them settle in the eyes, where, if they form small tumors, they may affect the nerve and cause blindness. Sometimes the tumors are hidden and cannot be located. For such cases there is absolutely no remedy and nothing will prevent loss of sight.

As stated, we had been sent out to make a study of the many and devious roads and trails that onchocerciasis is following from place to place. We had now come to the first place on our long journey where the population was 100% infected with the disease. Nature in its most exuberant mood had created an earthly paradise at Unión Fronteriza, and its people can scarcely see all this beauty. The microfilaria of onchocerciasis is creeping under their skins, and the life-giving sun tortures their eyes until the night of blindness comes upon them.

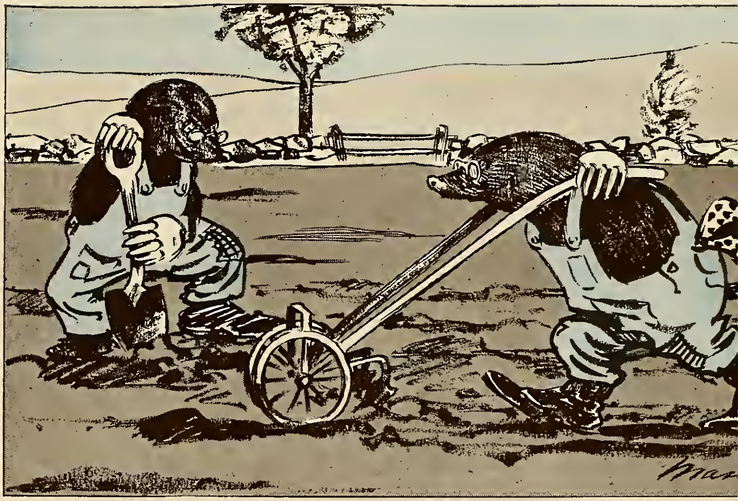
Taking the letter of introduction from the municipal agent, we read it to him, and he immediately installed us in the vacant school

Continued on page 237

Animal Cultivators

By John Eric Hill

Drawing by
G. Frederick Mason



LONG before men invented plows and other tools for cultivating the soil, many animals were working with similar effect.

Animals continually bring deeper soil to the surface, where it is exposed to weathering. Water then penetrates the ground through their burrows and, as a sponge holds water, the porous earth reduces the run-off in wet weather. The increased moisture leads to a better growth of vegetation, which in turn enriches the soil. Burrowing animals commonly make their homes under rocks and logs. After each rain the rock or log sinks a little, and the animals living underneath must excavate more earth. This is piled up around the rock or log and gradually covers it.

Although many other animals work the soil, moles are the most conspicuous cultivators throughout much of the Northern Hemisphere. When we see the irregularly rounded ridges of a mole's runway crossing the lawn or wandering along the rows of a garden, our reaction is generally one of enmity. The mole industriously pushes its way through the earth, up-rooting delicate plants and sod. Here and there it pushes up "fountains" of earth that may cover and smother plants. Also, moles eat some vegetable matter: certain bulbs, tubers, and seeds. However, it is only in cultivated land that moles are injurious, and even here they usually pay for their damage by the number of grubs they eat.

The common mole is well fitted for its burrowing life. Its shape is streamlined, the head sharply pointed. The front limbs are short and powerful, set far forward so that they look as if they came out from the sides of the neck, immediately behind the head. The broad and shovel-like forefeet are armed with stout, sharp claws.

The mole's methods of digging are different from those of other animals and can be studied by putting the animal in a narrow glass cage packed with earth. The mole will then dig without paying attention to those who are watching him, especially in artificial light.

Moles make two kinds of tunnels, the surface runways we see on the lawns, and deep burrows. When working only a few inches below the surface, the mole twists the front part of its body to one side. The forefoot underneath pushes against the floor of the tunnel, while the opposite foot is brought up along the muzzle and thrust vigorously upward, pushing up the roof of the runway. From time to time the mole changes its position, exchanging one forelimb for the other. Meanwhile, its sensitive snout is moving about rapidly as if to locate food or anything unusual in the newly exposed earth.

In excavating deep tunnels a foot or more below the surface, other methods must be used. The head is turned to the right. The left front foot is brought forward, then is powerfully drawn back, scooping out some earth. The head is next bent to the other side and the right paw scoops out more earth. At each stroke the earth is thrown back under the mole's body. The hind feet are brought forward under the belly to kick the loose earth backward. After a pile of earth has accumulated, the mole makes a tight somersault in its burrow. Then it pushes the pile of earth in front of it along the tunnel, using first one broad shovel-paw and then the other, hitching along on the three other limbs. When the vertical tunnel leading to the surface is reached, the loose earth is pushed into it, causing an equal amount to be forced out the top, in the center of the mole hill, somewhat on the principle of a sausage-stuffing machine. The surplus earth falls down the sides, giving the familiar mole hill its typical appearance.

In comparison with its size, the mole moves enormous amounts of earth. In suitable soil it may dig at the rate of twelve feet or more per hour and may keep this up day and night. One mole is even known to have made a run of nearly a hundred yards in a single night after a rain. Since the common mole is only about five or six inches long, not counting the tail, this feat would compare with that of a man digging a tunnel, large enough for him to crawl through, over half a mile long. In tests of strength, moles have also proved extraordinary, lifting objects more than 30 times their own weight.

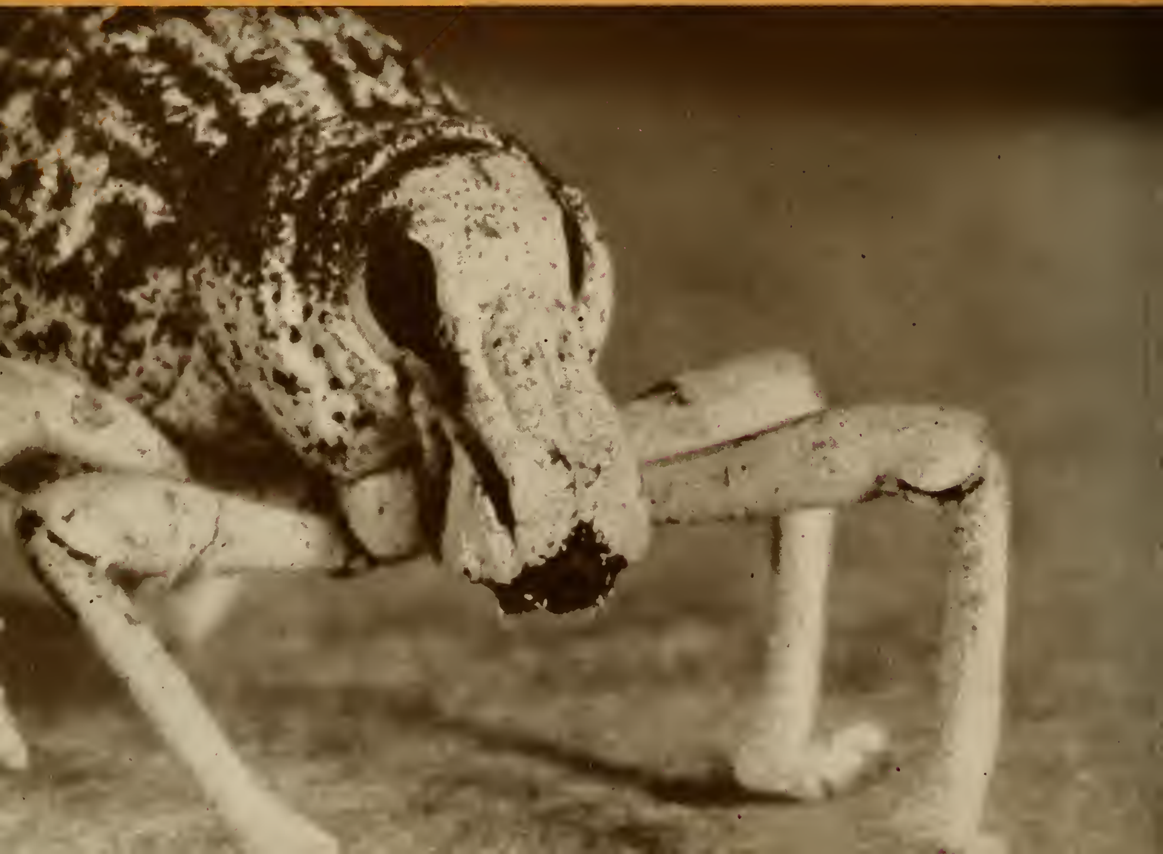
BIG PORTRAITS *of* TINY CREATURES

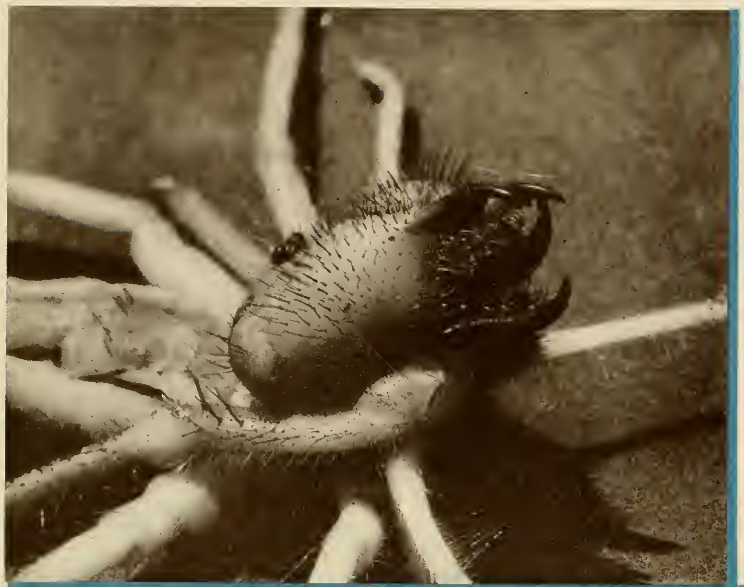
➤ THIS WINGLESS INSECT of unkempt appearance is a female "velvet ant." Just as our robin is not a robin but a thrush, so the velvet ant is not an ant but a wasp. The scientific name for this species is *Dasymutilla gloriosa.* In the enlargement the bizarre beauty of "the glorious one" is revealed. The hairs are white in the female. The male, in contrast, has red and black hairs and is winged. Gloriosa lives in the deserts of our Southwest

By RICHARD L. CASSELL

▼ THE BROAD, blunt beak of this weevil (*Eupagoderes* sp.) is a tribal characteristic that distinguishes it from most of the other members of the weevil family (Curculionidae). There are about fifteen species in this genus, all found in the southwestern United States. Not much is known about their habits. The white pattern is made of small scales. In repose, the basal segment of the angled antennae rests in the black grooves on the sides of the head

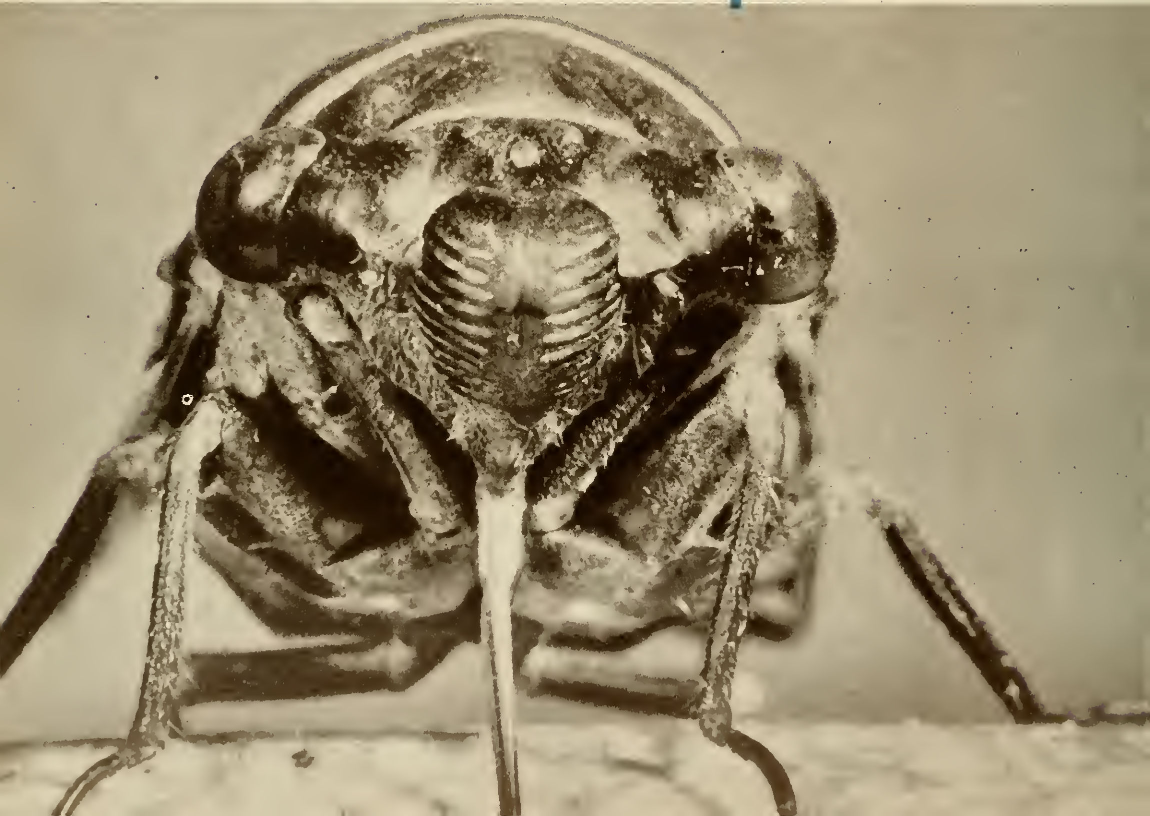
➘ THIS HEAVY-BODIED oil beetle (*Cysteodemus armatus* Lec.) is limited to a crawling life on the ground or vegetation, because it has no flying wings. The wing covers or elytra have grown together and are deeply pitted. The ridges between these pits are frequently decorated with a beautiful greenish secretion, which is also present on the thorax. Two species of this genus are known, and they both occur in the southwestern states





◄ ENORMOUS, BEWHISKERED JAWS, which in proportion to size are not matched by any other arachnid, are the most striking feature of the solpugid. Although admirably fitted with stout teeth for sawing and crushing insect prey, these grotesque creatures of deserts and arid regions have no venom and need not be feared by man. Our species are active chiefly at night, but some exotic forms, notorious for their speed and agility, hunt during the day and are called sun- or wind-scorpions

▼ ONE DOES NOT fully envision in this head-on portrait the well known Apache cicada of the Southwest because the great, membranous wings, lined with bright yellow or orange, are hidden from view. Appearing in vast numbers on the mesquite during the hot summer months, Apache advertises his desire for a mate with shrill, monotonous screaming and, courting with deafening insistence, gains reward by attentive notice from his voiceless mate. The jointed beak is used for sucking juices from the trees on which the cicadas congregate



Continued from page 232

house, empty because no teachers have stayed very long for fear of the ghastly scourge. From time to time units of doctors and male nurses, sent out by the Mexican Government, arrive to take care of the natives. These men operate and extract the tumors that show where the parasites have lodged, and thereby effect a temporary cure. But the infected flies are everywhere, and a person operated on one day may be infected again the next.

Quickly the news went around that we had come, and just as quickly the sick, near-blind, and blind began to gather around our quarters. It was awful to see. Our group was not equipped to operate on the onchocerciasis tumors. The object of our visit was to inform ourselves about the daily life of these suffering people; yet now they came to us for help. Mothers, with one baby at their breasts and two or three little ones trailing behind, came to our door.

"When will you extract our *bolas* (tumors) when will you cut out my *quiste* (cyst)?"

Don José Parra, who for years has painstakingly studied the life cycle of the flies that transmit the disease and who knows the symptoms and manifestations, examined all comers and soothed them by telling them that a party of doctors would soon come to their aid. We made notes of his observations. Whole families turned up, and all either had been operated on or had all the signs of the disease. Young and strong men shaded their eyes against the sunlight and old men tapped their way to our door with their sticks.

Later we visted the houses, lying scattered among the gardens. The last house stood high up on the slope above the village, commanding a magnificent view of the rich valley and the wooded mountainside. We could see our trail winding down among the pine trees.

An old man was busily cleaning coffee beans, turning a long paddle around in a large wooden basin.

"Good afternoon!" we said as we stretched our hands out in greeting.

"Be welcome to my poor house and be seated," he answered, as he moved over a couple of long low seats. His voice was sad, and he left our hands outstretched in midair, without shaking them in the way of good Mexican hospitality. Finally he seemed to look in our direction, and we saw that he was blind. His eyes were a mottled brown, and the expression on his face was that of a man who wishes to see and cannot. The sound of our voices drew his face toward us.

"I cannot see. Many years have passed in darkness. When the first *bolitas* came, there was no brigade of doctors, and our employers on the coffee plantations did not care if we suffered. They would not employ those who had been infected on their plantations. They could always find more Indians who were good for work. Now I am no good, I am *useless*. Now I can only sit here and clean a few coffee beans, the work that every child can do." His voice wandered away, and his thoughts seemed to remember the days, long ago, when he could see the beauty of his little house and his little farm and his children.

"*Como está usted, señorita?* (How are you, miss?)." The voice came from behind us. A husky man entered to shake hands with Miss Duby.

"This is my son," said the blind old man. "He also goes to work on the coffee plantations every year, and he also will be blind."

"They have operated on me many times," the son said. "I have to go back to the plantation to make some money, and now my eyes are not so good. Come out from hiding, Pedrito, and say good day to the señorita."

A small boy, some three years old, came out from behind the door, where he had been watching the strange visitors. He was shading his eyes from the bright sunlight that streamed in through the open door.

"Show the lady your *bolitas,*" said the father to him, and in a moment Pedrito parted his hair and placed his small fingers on an onchocerciasis tumor, as if it were the most natural thing in the world.

"But, Don Juan, did you not take your grandchild to be operated when the medicos came through here the last time?" asked Miss Duby.

"He was operated—my Pedrito—but his *bola* is new since then."

Now little Pedrito has to wait for many months until the next medical brigade returns to Unión Fronteriza, and he must hold up his hand to shade his eyes, because the bright sun burns and hurts.

Three generations! The old man is blind, the son is near-blind, and the grandson will be blind. Calmly these people accept the suffering as a "*castigo de Dios.*" They cannot fathom why God should punish them, but they reason that He must have a reason.

Night was coming on rapidly when three small girls, the oldest not more than eight years of age, appeared at our door. In her young, clear voice the oldest asked:

"*Señores,* when will you cut out our little tumors?" It was pathetic. It was horrible and utterly depressing, because we knew only too well that the doctors as yet have no definite remedy. Eager workers are trying their best, but if the tumors are not removed in time there is no help. Malaria can be treated, and since the malaria mosquito lays its eggs in stagnant water the breeding places can be controlled with oil. Not so with the onchocerciasis-infected fly. It lays its eggs on leaves and grass and rocks close to running water. How can one immunize a mountain torrent or an irrigation ditch? It may be that the famed DDT will do it. Experiments are under way. Meanwhile the malady is spreading rapidly, carried by man from place to place.

Take the case of Unión Fronteriza, where nature has provided so abundantly the things for life. The village lies far back in the mountains, and the villagers can-

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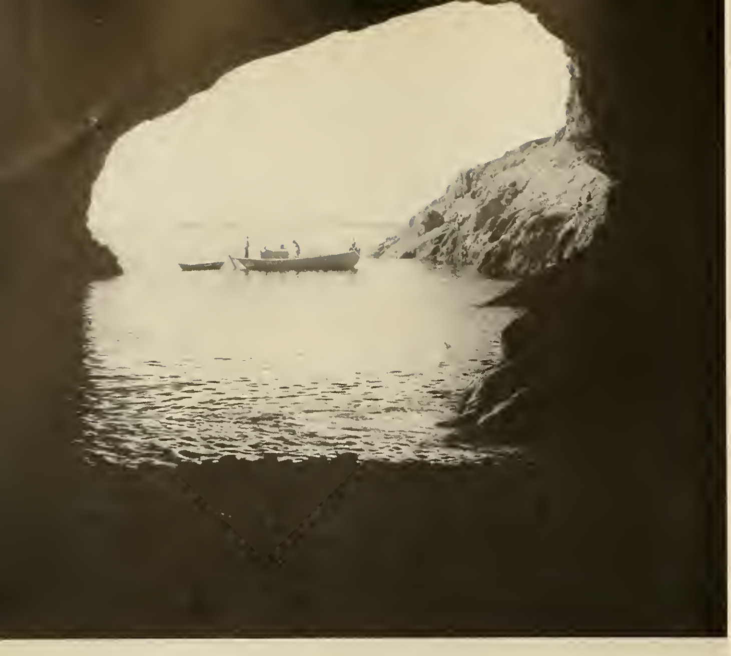


◄ THE MOUTH of the huge sea cave near the northern tip of Newfoundland was found to be about 60 feet wide and 40 feet high. The length of the cave is about 300 feet

Geological Survey of Newfoundland photos, by the author

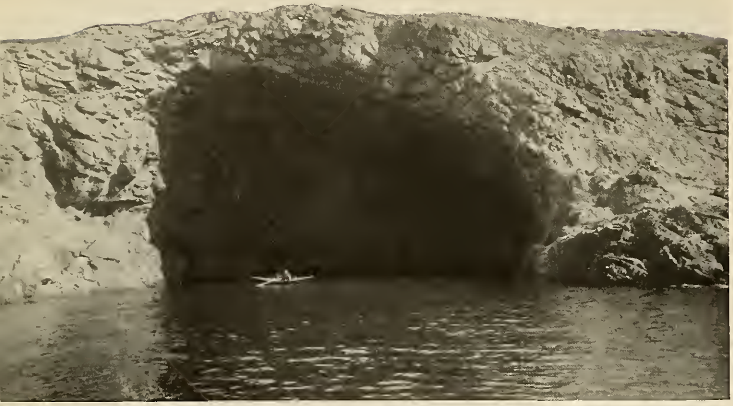
The BIG
a WHALE o

SEA caves of moderate size are not uncommon. The writer has seen many of them in the limestone and lava cliffs of northern Newfoundland and the Gaspé coast of Quebec. Some have a height of 15 to 20 feet and have been eroded into the cliff for a distance of 20 to 30 feet. Much smaller ones are the rule. It is therefore of interest to have found an exceptionally large one and to record its occurrence near the northern tip of Newfoundland.

During the summer of 1945 the writer was engaged in mapping the geology of the Pistolet Bay area at the eastern end of the Strait of Belle Isle, for the Geological Survey of Newfoundland. From the west side of the bay on clear days a dark spot could be seen on the limestone cliffs of Burnt Island on the other side of the bay. This we supposed to be a deep ravine casting a shadow on the rocks within. When we moved camp to the east side of the bay we steered for the dark spot to get a closer view. While yet two miles distant it became apparent that it was a gigantic sea cave. A closer approach showed that waves ran in out of sight in the darkness within. As our boat was heavily laden and the sea far from calm, we proceeded to the sheltered water on the east side of Burnt Island.

Here we pitched camp on the shore by the fish flakes (drying racks) of Edward Evans and his son Louis. Theirs is the only home on Burnt Island; other inhabitants of Raleigh live on the east side of Raleigh Harbour. Most of the island north of the Evans' home is treeless and has large bare rock exposures. Here ground water has dissolved out a number of sinkholes and on the east side of the island produced ravines along lines of faults which run in a north-south direction.

In the course of our examination of the rocks a visit to the large sea cave was made on foot. The Evans had said it was possible only in winter to enter the Big Oven, as they call it, without a boat, at which time the sea is frozen. However, two members of our party managed to hug the cliff at the entrance on the north side so as to reach the limestone shelf within and walk back to the beach halfway in and thence to the end of the cave. Coming out they found the footing more perilous and felt sure they would slip into the deep water at the entrance. Somehow they managed to get out safely,



▲ IN CALM WEATHER it was possible to enter the Big Oven by boat

▼ THE WEST SIDE of Burnt Island shows a steplike terrace or raised beach. This presumably was cut by the sea at a time when the relative position of the water was higher

By Cecil H. Kindle
Department of Geology, College of the City of New York

VEN,
Sea Cave

but nothing would induce them to try it again.

At last a clear, calm day arrived. Louis Evans took us in his large fishing boat to see the Big Oven. Very impressive it was to sail into this high vaulted cavern. The water was about 30 feet deep at the entrance and remained deep till near the beach. On either side was a wide shelf which provided an excellent landing from the boat. Pebbles made up the floor back of the beach. The roof of the cave sloped down gradually at the back to meet the pebbly floor about 300 feet from the entrance. The opening of the cave has a width of about 60 feet. Its height above water is about 40 feet. The tidal range here is only about five feet.

Sea caves that compare with the Big Oven are found on the small island of Staffa in the Hebrides off the northwest coast of Scotland. Here waves have attacked lavas, some of which have well-developed columnar jointing. This jointing has resulted in vertical walls and greater regularity than is seen in the dolomitic limestone walls of the Big Oven. The best known on Staffa is Fingal's Cave, which has a length of 227 feet. The entrance has a height of 66 feet and a breadth of 42 feet. MacKinnon's Cave on Staffa has a length of 224 feet with a large square entrance 50 feet high and 48 feet wide. A comparison of these figures shows that the Big Oven has a much wider entrance than the others and is longer. It does not have as high a roof nor is it as symmetrical in outline.

The roof in the Big Oven slopes in the direction of a fault or slip in the dolomitic limestone. This faulting has probably had much to do with the formation of the cave, by providing a weak zone for wave attack. It is possible that ground water may have assisted in forming the cave formation by dissolving the rock. Sinkholes on the island show that considerable solution has taken place. That there are cavities at sea level is shown on the eastern side of the island by a strong flow of sea water that issues as a stream through the beach gravel after every high tide. If the shore in that area were exposed to strong wave erosion, a hidden cavity of this sort would in time be exposed as a sea cave. So it seems probable that wave action and the work of underground water have both had a part in producing this giant among sea caves.

DARKNESS
To All Who Dwell There

Continued from page 237

not sell their produce, because the costs of transportation are prohibitive. There is no road, only a foot trail. There is everything in Unión Fronteriza except cash. The men need machetes and other metal tools; the women need grinding stones to make the daily tortillas; all need clothing. Therefore the men seek work every year on the coffee plantations, where there is plenty of opportunity to become infected with onchocerciasis. They finish their contracts, receive their pay, and return home to their families and their fields. In their bodies they carry millions of onchocerciasis microfilaria.

We arranged ourselves for the night, cooked our supper, and hung up our hammocks. The Indians had brought us pineapples, bananas, and some tasty *zapotes,* and our animals were led off to pasture. But we were unable to sleep, having seen so much sadness. Far into the night we talked.

Where did onchocerciasis come from? It is believed to have originated in Africa. It may have crossed the Atlantic in the bodies of Negro slaves, or infected flies may have been imported in bundles of coffee plants. It was first noted on the American continent about 30 years ago, but by then it was already well established, and now it is spreading farther and farther. Every place where the climate and vegetation is propitious for the Simulidae is dangerous. Winds or man may carry the fly to new fields. By conservative estimates, more than 100,000 people are infected with onchocerciasis, and every year this number is increasing.

What can be done? Kill the fly and its eggs? Isolate the infected people? But how will one isolate these Indians, who come and go over hidden trails known only to themselves? It will be costly, immensely costly, to combat the scourge, but how much money is it not worth to protect the eyesight of millions of people?

Early the next morning our horses were brought in for their breakfast of corn, and with them came more sick Indians. Many of them had large goiters, and all of them had onchocerciasis. They stood at the doors and windows of our house, watching the strangers with curiosity. Those who could see told the others about our doings. They wanted us to help them. Imagine a father and mother bringing their sick children, knowing that if proper help does not come in time, they will be blind within a few years. Many of these people know that they themselves are beyond help, but they want to save their children. It was most difficult for us to get portraits, because all who could still see either shaded their eyes against the burning sunlight or looked toward the ground. Even the morning sun was too much for them.

Our visit had become a kind of village entertainment. The blind and near-blind sat on our shady front porch, chatting contentedly and laughing at one another's jokes. A small boy came presently to tell us that he had been operated on and at present did not have any tumors. All the children were confident and unafraid, except one youngster, who howled and kicked. Señor Parra's mild manner and kind voice calmed the kid, and he submitted to examination. His was the only case of fear. The entire community understood the danger that was part of their lives.

We spent the whole day with these kind people, visiting in their houses, buying food from them, and sometimes receiving gifts of a couple of eggs or some bananas. The following morning we saddled our horses to leave. As we rode out of the village, many men and women stood at the doors of their houses waving farewell to us. Down the trail we rode, through the fields and the orchid forest.

* * *

Dr. Luis Figueroa of the Huixtla Hospital, Dr. Rudolf Nettle, and many other doctors are searching for a remedy, and by trial and error are eliminating the unusable. As yet they have not found the answer.

Uninvited Guests in the House

THE HOUSE CENTIPEDE

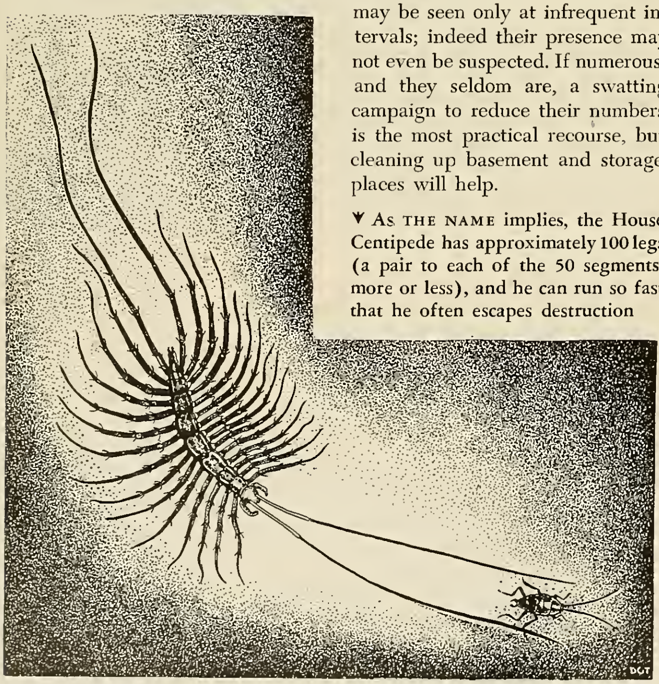
By C. H. Curran

Associate Curator,
Department of Insects and Spiders,
The American Museum of Natural History

THE House Centipede is not an insect but, since it is often looked upon as a household pest, it is invariably included in textbooks dealing with insects of the household. It is a long-legged relative of the centipedes that are so common out of doors in rotting wood or in decaying vegetation. All centipedes are predaceous, feeding upon insects and other small animals, and all inject a poison into the victim when they bite. They use their poison essentially for anesthetizing their victims, which they can then eat at leisure. Their use of it as a protective weapon is entirely incidental.

The poison of most centipedes is quite ineffective against man, and as a general rule there is very little swelling, regardless of the size of the centipede. However, there are a few kinds that are fairly poisonous, and the House Centipede (*Scutigera forceps*) may be included in this group. There are a few records of serious bites, in which the affected part swelled very considerably and much pain was experienced. Usually, however, the bite is no worse than the sting of a bee.

House Centipedes are actually beneficial, because they feed on flies, mosquitoes, bedbugs, roaches, and other household insects; but it must be admitted their appearance is rather unattractive. They are able to crawl with remarkable speed and thus may evade destruction. Since they are nocturnal, they may be seen only at infrequent intervals; indeed their presence may not even be suspected. If numerous, and they seldom are, a swatting campaign to reduce their numbers is the most practical recourse, but cleaning up basement and storage places will help.



▼ As THE NAME implies, the House Centipede has approximately 100 legs (a pair to each of the 50 segments, more or less), and he can run so fast that he often escapes destruction

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LOST CONTINENTS

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Mayan writing by Le Plongeon's code got nothing but gibberish, as did those who used the "Mayan alphabet" of de Landa.

From the Troano Codex in the National Archaeological Museum of Madrid—one of the few Mayan manuscripts that survived de Landa's burning and one which nobody but a few gifted pseudoscientific Atlantists can read—and from some pictures on the walls of Chichen-Itza, Le Plongeon built a romantic tale. It concerned the rivalry of the princes Coh and Aac for the hand of their sister Móo, queen of Atlantis or Mu. Coh won, but was murdered by Aac; and then the continent sank and Móo fled to Egypt where, as Isis, she founded the Egyptian civilization.

In 1912 Paul Schliemann, grandson of the great Heinrich Schliemann who dug up Troy, gave the *New York American* a sensational tale of how his grandfather left secret papers instructing him to break open an owl-headed vase. Schliemann did and found therein archaeological specimens bearing Phoenician writing that told of Atlantis. He also claimed to have read the Troano manuscript and a Chaldean manuscript from Tibet, both of which told of the sinking of the land of Mu. Further revelations were promised but never came, nor did the vase and its contents ever see the light of public investigation.

Finally there was James Churchward, who in the 1920's and 30's wrote the Mu books, such as *The Lost Continent of Mu*, containing perhaps the greatest mass of drivel to be found in modern literature. Churchward's primary source was the mysterious "Naacal tablets," which he said had been shown and translated to him by an anonymous Hindu temple priest. His "authorities" were the discredited Schliemann and Le Plongeon. His "facts" were mostly wrong, like the Otomi-Japanese identity. His theory was an enlargement of the Le Plongeon and Schliemann aberrations. He had Atlantis in the Atlantic and Mu (the occultists' Lemuria) in the Pacific.

Churchward's reasoning processes were a marvel. He claimed a preternatural ability to read the "symbols" of various ancient peoples (a favorite occult obsession). Churchward said that the rectangle was M in the Muvian alphabet, hence the symbol for Mu; therefore any decorative use of a rectangle was evidence of derivation from Mu. As the ordinary brick is entirely bounded by rectangles, Churchward easily derived everybody and everything from Mu. He misquoted Plato and printed nonsensical footnotes reading, "4. Greek record." or "6. Various records." He disbelieved in the "monkey theories" of evolution, holding that man was created fully civilized in the Pliocene epoch; also that continents subsided because great gas-filled chambers under them ("gas belts") collapsed.

Lemuria and Gondwanaland

A word about Lemuria: About 1875 the scientists Haeckel and Blanford suggested that the distribution of lemurs and their relatives could best be explained by a former land bridge connecting Africa, Madagascar, and the East Indies. P. L. Sclater proposed the name *Lemuria* for this land, and the word came into general use among geologists. But more recent investigations show that the vanished continent of Lemuria is not necessary to explain the distribution of lemurs, and in fact fails to do so. Lemuria was conceived to be part of a much larger continent, Gondwanaland, which was supposed to have reached three-quarters of the way around the Southern Hemisphere, with a gap in the Pacific. Scientifically, these continents have little to do with Atlantism, and even Gondwanaland is considered speculative, although it is still widely accepted.

The Lemuria theory was picked up by that fascinating thaumaturge, Heliona P. Blavatsky, and incorporated into her own gaudy cosmos along with Atlantis. According to her works and those of her disciples, the Lemurians were the Third Root Race: gigantic apelike men, hermaphroditic and oviparous, some with four arms and some with a third eye at the back of their heads. They interbred with animals, the offspring being the ancestors of the apes. Their discovery of sex (of which Mme. Blavatsky took a poor view) caused their downfall. They were succeeded by the Atlanteans, the Fourth Root Race and the ancestors of the modern Mongoloids. Both the Third and Fourth Races were full of Cosmic Consciousness. There is much more, but interested readers can consult the works of Blavatsky, A. P. Sinnett, A. W. Besant, Scott-Elliott, R. Steiner, T. L. Harris, J. B. Newbrough, and other seekers after the higher wisdom. It is hardly worthwhile to argue with them, as they profess contempt for the methods of "materialistic" science and as their "evidence" consists of records in secret libraries in Tibet to which nobody but occultists have access.

Some occult Atlantists moved Lemuria from the Indian Ocean (where Mme. Blavatsky had the grace to leave it) to the Central Pacific (where it is unlikely there ever was a continent). In 1894 a novel, *A Dweller on Two Planets* by "Phylos the Thibetan" (F. S. Oliver) described, along with the last days of Atlantis, an occult brotherhood living on Mt. Shasta, in northern California. The "Mt. Shasta Legend" was incorporated into the occult Atlantis tradition, and tales are published now and then of Lemurians in white nightgowns living on the mountain and practicing mystic rites, despite the fact that campers and state forest officials wander freely over Shasta without meeting these interesting persons.

Let's look at Plato's story again. It is certainly not, as it implies, a stenographic record of a real conversation that took place three-quarters of a century before. Putting imaginary speeches in the mouths of historical characters was accepted practice in Plato's day—even the conscientious Thucydides did it—, and it has not utterly disappeared yet. Eliminating things obviously fictional, such as the god Poseidón, the tale has nothing that Plato could not have derived from the knowledge of his time: the defeat by Athens of barbarian invaders from the Persian wars, the city plan of Atlantis from Babylon, the harbor works from Syracuse, the Atlantean ceremonial from Orphism, and the earthquake from the real tremor that shook Greece in 373 B.C. The unity and verisimilitude of the tale are not beyond the abilities of a competent storyteller, especially one of Plato's intellect.

It is, in fact, hinted that Plato is writing what we should call a science-fiction story to illustrate his political theories. In *Timaeus*, Critias says, "And the city with its citizens which you described to us yesterday," (i.e. *The Republic*) "we will now transport hither into the realm of fact; for we will assume that the city is that ancient city of yours, and declare that the citizens you conceived are in truth those actual progenitors of ours, of whom the priest told."

The strange ending of *Critias* may be significant. Perhaps old Plato lost interest, or perhaps he had plot trouble. He started out to show how his *Republic* would work in practice, and then brought in the gods, which involved him in hopeless logical difficulties about free will and divine justice. The ruin of Athens by the quake, necessary to provide a gap in history between Plato's fictional Athens and the real one, did not square with divine justice. So maybe he puzzled a while and gave it up.

The conflict with geology

Besides Poseidón there are other obviously fictional elements: there is no record of the prehistoric Athenian empire; if it had existed, its remains could hardly have been missed in a country so well-excavated as Greece. Critias is inconsistent: in *Timaeus* he lay awake all night trying to remember the story; in *Critias* he has it at home in manuscript. (The "old manuscript" is a common literary device, often used by Poe.) There are good geological reasons for refusing to believe that any island of continental size ever sank out of sight as a result of one or a few earthquakes. The material has to go somewhere, and vast gas-filled chambers deep in the earth would violate the known laws of physics. A volcanic eruption may make drastic changes over a few square miles, but appreciable continental changes take place over millions of years. Relative motion of parts of the earth's crust during earthquakes (permanent changes, that is) are measured in inches or feet; the very severe San Francisco quake of 1906 produced relative movements of 22 feet.

The substance of myths

Atlantists who confer Atlantean origin on the Egyptians and Mayas infer that Noah's flood and a Mexican flood-legend are both disguised traditions of the sinking of Atlantis. Now it is one thing to admit that myths, like all fiction, have a basis in fact, and quite another to think that one can reconstruct the fact from the fiction. Sinclair Lewis's novel *It Can't Happen Here* is based on certain facts. But a future historian, who knew nothing else about the twentieth century and tried to reconstruct the history of the United States from that novel, might easily conclude that Windrip the dictator was a real man but that Franklin Roosevelt was a myth, like Osiris. Myths may and generally do distort reality out of all possibility of recognition.

Myths are not handed down to posterity for the simple love of historical fact—a rare quality even in our culture. They are passed on because they are entertaining, and so provide a living for story-tellers, or because they are useful in answering children's questions, serving as librettos for rites, or keeping the laity subservient to the priesthood.

The cultural arguments for an Egyptian-Mayan connection concentrate on resemblances and ignore differences, which are so profound as to make the resemblances look petty and accidental. The New and Old Worlds had no food plants in common. It is incredible that if Atlanteans had colonized Mexico and Egypt, they would have taken wheat to Egypt and maize to Mexico but not vice versa. They had no domestic animals in common but the dog. The Mayans lacked the plow and the wheel. The Mayan calendar was drastically different from those of the Old World, being based on a year of eighteen 20-day months instead of twelve 30-day months. The Egyptian writing, Atlantists to the contrary, has been of no help in decoding Mayan inscriptions. Atlantean chronology, judging from the excellent Mayan system of dating, is wrong: the Mayan civilization arose about the beginning of the Christian era, when Egypt was thousands of years old. We must conclude that the Mayans' forebears arrived unburdened by food-plants, animals other than dogs, writing, or calendars—that is, as savages.

The linguistic arguments are like those by which people "prove" that the Lost Ten Tribes are the Aztecs or the Irish or the Burmese. You find two words in different languages having a similar sound and meaning, and conclude that the two languages are related, under the mistaken impression that this is the science of philology.

Coincidence in language

The study of linguistic relationships is more complicated than that. There are almost sure to be a few apparent similarities in *any* pair of languages. "Ten" is *dix* in French and *disi* in Hottentot; "search" is *examine* in English and *eggāmen* in Tuareg; "time" is *hour* in Szechuanese, and so on. The reason is that most languages have but 20 to 50 significent sound-units, and at least several thousand words. So some pseudocognates are inevitable by coincidence. To find linguistic relations, one must consider *all* the words in certain classes, such as numbers, colors, family relationships ("father" etc.), parts of the body, natural categories ("water" etc.), and so on.

Let's do an experiment along these lines, which may shed light on the assertion of Le Plongeon that Mayan is one-third Greek, and of Braghine (who in his Atlantis book used forgeries of antiques for his frontispiece) and others that Otomi is Old Japanese:

English	Greek	Japanese	Mayan	Otomi (Tepehua dialect)
one	ein	hitotu	hun	da
two	dyo	futatu	ca	yojo
three	tri	mitu	ox	tiu
four	tettares	yotu	can	coojo
five	pente	itutu	ho	guitta
six	hex	mutu	uac	dato
seven	hepta	nanatu	uuc	yoto
eight	októ	yatu	uaxac	giato
nine	ennea	kokonotu	bolon	guito
ten	deka	tō	lahun	detdta[1]

The English-Greek resemblance is obvious; but the other languages show no resemblances at all, as far as this table goes. Adding Chinese, Hebrew, or Aztec to the table does not help the Atlantists. This list is not a "disproof," just a sample to show that the languages in question are not as similar as has been claimed. For an analysis of linguistic relations a much larger list of words would be needed, and also a study of phonology, inflection, and syntax.

When the American languages are so studied, these conclusions appear: Eskimo is related to the languages of Eastern Siberia, which is hardly surprising. The American Indian languages, however, show a wide diversity among themselves, and *no* clear relationship to any Old World language; some show grammatical features like those of the Ural-Altaic languages, like Turkish, which spread out from Central Asia.

Some Atlantists say that numerous inscriptions in Old World languages have been found in the Americas, though they usually neglect to tell us where these wonders are to be seen. When these cases of "Phoenician inscriptions" are investigated, they turn out to be something other than what was supposed. Dighton Rock in Massachusetts had its scratches attributed to the Phoenicians, Druids, Hebrews, Chinese, and Atlanteans, until Prof.

---

[1] The Japanese syllable *tu* is pronounced *tsu*, *u* as in "put." Mayan *x* = English *sh*. There is another set of Japanese numerals borrowed from Chinese: *iti*, *ni*, *san*, etc.

E. B. Delaware, with black filling-material and a camera, disclosed the name of Miguel Cortereal, a Portuguese explorer who sailed for Newfoundland in 1502 and never returned. The Grace Creek Mound stone from West Virginia was analyzed as Etruscan, Runic, Phoenician, Old British, Celtiberic, and Greek, and when finally solved in 1930 proved to read, "Bill Stump's Stone, October 14, 1838."

Then what is there to the sunken continents and vanished civilizations? There is something, but we shan't get it from Plato or from Donnelly.

It can be agreed that some of the present land was once water and vice versa. The difficulty comes in trying to find what parts of the globe were dry during a given geological period, say the Triassic. If a place has a fossil-bearing Triassic deposit on the surface, the answer can be easily determined. But if there is no such deposit where we can reach it, or if the area is at the bottom of the sea, we have to resort to inference to determine what the place was like in the Triassic. The farther back we go, the more scanty the evidence becomes and the more uncertain our inferences. But the problem is not hopeless. Much can be learned by studying the distribution of fossil organisms and the structure of the earth.

There is some geological evidence that the Azores Islands, situated about 1000 miles west of Gibraltar, may be the remains of an island that was once as large as Spain. If anybody wants to call it Atlantis, there seems no good reason to object. But there is little likelihood of a prehistoric civilization there. Most of the geologists who think this land mass existed, believe it had sunk by the end of the Miocene period, some 15 or 20 million years ago, which was long before the appearance on earth of the most primitive men.

As for undiscovered civilizations, Europe has been well picked over, and sensational discoveries of high cultures there seem unlikely. The rise of the Mayans from barbarism has been fairly well charted. But Asia has hardly been scratched archaeologically. Within the last few decades an Indus Valley civilization contemporary with the Sumerians has come to light, and further discoveries are not unlikely. But we should not expect four-armed hermaphrodites with astral bodies and airplanes. They are more likely to be just people; the men tending herds and crops, building houses, and making utensils; women cooking and sewing; kings waging war and dispensing justice.

The most reasonable way to regard Plato's story of Atlantis would seem to be as an impressive if abortive attempt at a politico-historical romance, based on materials of Plato's own time and possibly also on traditions of Crete or Tartessos or both—a romance which has been kept alive partly by its literary merit, partly by its nostalgic emotional appeal, and partly by Plato's philosophical reputation. That is no reason for not enjoying it. We enjoy *Alice in Wonderland,* though it isn't history. And I'm sure Plato doesn't care.

YOUR NEW BOOKS

Continued from page 203

written some charming, pithy descriptions which are almost poetic at times. His selection of words is strikingly appropriate for the subjects described. The material in the book ranges from glaciers and trilobites to butterflies, purple onions, bison, aspen, goats, and grouse, a cross-section of the Northwest.

The style of writing is straightforward without technical complexities—the kind that is pleasant to read to someone or to have read to you. The author's extensive lecturing has probably helped him to present his information so directly that it is read and remembered without effort. The illustrations and the word pictures will bring back fond remembrances to anyone who has spent time in the Rocky Mountains, whether in Canada or the United States, and will create a yearning to visit that region in those who have not been so fortunate.

Mr. McCowan has prepared for each of his 46 illustrations a very complete stock of pertinent information for such a limited space. In nearly every instance, he gives the common and scientific names, with derivation and meaning when of interest, a few facts about the behavior of the animals and their habitat, the features that identify them, and some human interest from his own experiences.

The best photographs are those of the pasque flower, bighorn sheep, bison, and goat; these are exceptional in quality. The reproductions suffer somewhat from the difficult publishing problems of today, involving the scarcity of the best paper. In a few instances the pictures are not as sharp as one would wish to see. However, all this in no way detracts from the attractiveness of the book.

Mr. Dan McCowan's little book is one which can be picked up at any time, opened to any double page, and read with enjoyment.

It is interesting to add that the author accompanied King George VI and Queen Elizabeth during their trip in 1939 through the Rocky and Selkirk Mountains, in the capacity of field naturalist.

THANE L. BIERWERT.

EDUCATION IN CONSERVATION OF SOIL AND WATER

Report of the Northern Great Plains Conservation Committee Summer Workshop, Lincoln, Nebraska

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Continued from page 201

the chameleon family? And do all hibernating reptiles feed only on living creatures before their long sleep?

Elisa Ward Lindenberg.
Williams, Arizona.

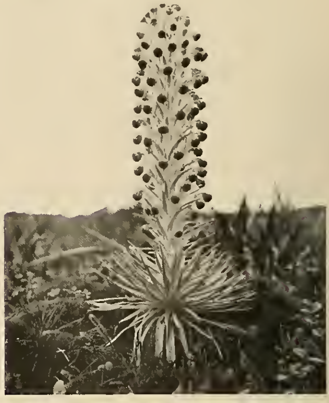
Mrs. Lindenberg's observation is interesting but somewhat perplexing. The sky-blue tail indicates without much doubt that the lizard was a juvenile of the many-lined skink (*Eumeces multivirgatus*). These somewhat secretive lizards occasionally venture out during the day, and the feeding behavior Mrs. Lindenberg describes is typical of most American skinks. However, conspicuous color changes from dark to light gray are not characteristic of lizards in this group. I have collected the many-lined skink in the vicinity of Flagstaff where, indeed, one fell from an awning over the post-office door and landed at my feet when I went for my mail. However, I do not recall any color change in those removed from cool, damp, hiding places and exposed to warmth.

On the other hand, there are three small iguanids (relatives of the large tropical iguana) found around Williams, Arizona, that are subject to rather extensive color changes. One summer between Mount Bill Williams and the Grand Canyon I caught a collared lizard (*Crotaphytus collaris*) that was bright green above when taken. A quarter of an hour later a hailstorm had caused the temperature to change abruptly, and the lizard was virtually black. The little tree utas (*Uta ornata*) in the same region may change rather abruptly from dark gray to light gray, the black pigment cells being contracted by a rise in body temperature, such as occurs when the animal basks. If Mrs. Lindenberg had seen one of these little utas, her account could easily be explained. If she saw a skink, as the blue tail indicates, her observation of color change may be one that seemingly has escaped the notice of herpetologists.

No close relatives of the Old World chameleons are known in the Americas. But the ability to change color is found in many groups of lizards, including geckos, iguanids, night lizards (Xantusia), and Old World agamids. Our American "chameleon" or anole (*Anolis carolinensis*) can change from brown to green. The true chameleons, however, have the greatest repertoire of change. Some African chameleons range through black, brown, green, and yellow; others can change very little.

All reptiles in cooler climates hibernate, but their food preferences vary. A few studies suggest some seasonal variation in the diet of lizards having more catholic tastes, but this results partly from seasonal abundance of food. There is no apparent relationship between food preference and the approach of hibernation.

C. M. Bogert.
The American Museum of
Natural History, New York, N. Y.



Sirs:

This photograph of the "West-Maui Silversword," comes from a distant but enthusiastic subscriber to your fine magazine. It was taken on Mt. Kukui in the Hawaiian Islands at an elevation of about 5,000 feet, in a country where the rainfall ranges from 350 to 450 inches a year. This particular plant (*Argyroxiphium caligini*) reaches a height of about three feet on the peat bogs of West Maui.

Its counterpart (*A. macrocephalum*) on Mt. Haleakala, East Maui, grows at elevations of about 7,000 to 10,000 feet in areas of light rainfall and reaches a height of perhaps six feet.

I doubt that a more beautiful plant can be found in the entire world.

D. T. Fleming.
Lahaina, Maui, T. H.

* * *

Sirs:

. . . I do not write many letters to editors, but I think it is fair to tell you that Natural History is, I think, the best magazine that comes to my home, and I regard your book reviews as one of your best departments. . . .

R. Grayson Dashiell.
Richmond, Va.

▼ A landscape in Jackson County, Missouri, photographed by Hubert A. Lowman, as summer thunder clouds rolled away to leave the sky clear for sunset

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L E T T E R S

Sirs:

. . . Although I rarely have the opportunity to visit the Museum in person, my contacts with it through Natural History Magazine are most enjoyable, to say nothing of the educational value of that publication.

Without hesitation and in all sincerity, I can say that, of all the magazines to which I subscribe, Natural History is the last one with which I would part. While I was overseas, my wife continued my membership and, as I considered the magazine too valuable to risk shipment abroad, I have, since returning, spent many perfect hours reading the articles I missed during that time. Incidentally, I have preserved every issue of Natural History that I have received in the six or seven years of my membership, and frequently refer back to an old issue to reread an article that I have particularly enjoyed. . . .

Harold L. Frier.

Cadillac, Mich.

* * *

Sirs:

. . . I am enclosing two photographs of a large toad found in the coastal strip of eastern Bahia and Sergipe, Brazil. This particular animal was photographed near Estancia, southern Sergipe. These toads [one of several large Neotropical species found in South America] are very common in the area, coming abroad at dusk in typical toad fashion. It is said that on occasion they serve to grace the family table. . . .

Robert W. Schery.

St. Louis, Mo.

* * *

Sirs:

I think I have a helpful word or two to add to your treatment of poison ivy dermatitis (April, 1946, page 169), gained from painful personal experience. It has to do with the method of applying the hot water. I found that I could allay the itching by pouring the hot water across the affected areas, which in my first experiences with ivy poisoning were quite extensive, involving my arms, legs, face, and scattered other places.

My method was to fill a small receptacle, like a foot-tub, with water that was pretty hot—hotter than I could hold my hand in. In this I would dissolve a very little mild soap. Then I would undress, stand up in the bathtub, place the foot-tub where I could reach it handily, and dip up the hot water in a pint cup and pour it over the affected places. The relief was instantaneous to the spots touched by the hot water, and I would keep pouring until I had reached them all. I added the soap with the idea of washing off the resinous sap of the ivy, and I think it worked, for I not only controlled the itching but also the spreading and the inflammation.

Since this first aggravated attack I have several times come home from fishing with the telltale blisters, which I was able to render innocuous by the application of silver nitrate in a ten per cent solution to each blister. To do this I took a wooden applicator (small round stick) dipped it into the solution and then applied the stick to the blister, twisting it around in the blister to break it open and let the silver nitrate come in contact with the virus of the ivy. This treatment left a small black dot at the site of the blister, but there was never any itching or spreading. The black dot of course was temporary, and the treatment positive.

Dr. Percy M. Williams.

Rutland, Vermont

* * *

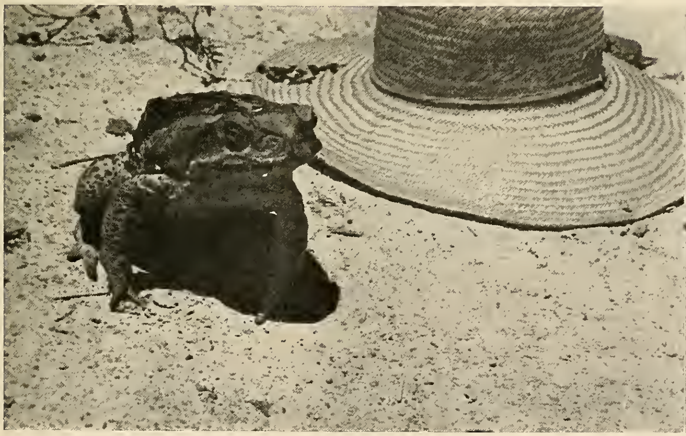
Sirs:

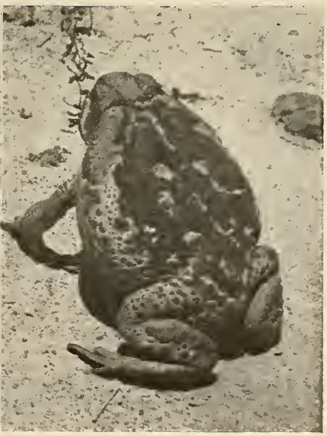
I most regretfully have to report to you that your heat method of poison ivy treatment is a snare and a delusion. I returned to my desk from a long weekend in the country . . . and at once gave your suggestion a thorough try. And don't for a minute think I didn't have the water hot enough! During the day at the office I made use of the electric light bulb. I grant you a temporary relief (after an almost intolerable increase in the itching during the first few minutes of application), but while depending on

Continued on page 248

IMPORTANT NOTICE

Readers are reminded that NATURAL HISTORY is not published during July and August. Those who expect to be away after September 1, however, and wish to have their September issue sent to a temporary summer address are requested to notify the Membership Secretary. Please give also the date of expected return to permanent address.





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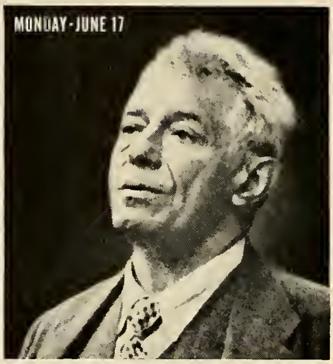

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Frederick Trubee Davison, President Albert E. Parr, Director

VOLUME LV—No. 6 **JUNE, 1946**

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You will find Natural History Magazine indexed in *Readers' Guide to Periodical Literature* in your library

THE COVER THIS MONTH

This Green Frog appeared unexpectedly one day in the lily pond of Edward S. Thomas, who is Curator of Natural History at the Ohio State Museum at Columbus, Ohio. Struck with the pictorial possibilities, he dashed to the house for the Exakta camera and Graflex which make up his "home-made telephoto." The 35 mm. camera was hurriedly attached to the back of the Graflex. A sprint to the garage brought a box on which to rest the outfit. It seemed too much to hope that the subject would "stay put" during all these preparations. But he did. In fact, he posed beautifully for several "time shots." The exposure was five seconds at F/22.

No frog is quite so ubiquitous around ponds and reservoirs in eastern North America as this handsome Green Frog (*Rana clamitans*). From Hudson Bay to northern Florida, from the Atlantic Coast to eastern Kansas, the Green Frog is likely to be encountered wherever there is even a meager supply of permanent water. A single female deposits as many as 5000 eggs, usually no earlier than May in the north but as early as April in Florida. Breeding may take place as late as August, but it never commences until the air temperature reaches 65° F. The tadpole spends the winter under the ice.

Green Frogs evidently become attached to individual pools. If carried away and released, they will return to the home pond, passing equally good sites to do so.

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your method, the eruption spread from my ankles all over both legs; by which time I gave up and went back to my old stand-by, yellow soap, just in time, I believe, to save myself a visit to the hospital. At any rate, the coating of soap prevented any further spreading except for one or two tiny spots that were quickly cured by a good scrub with a brush and soapsuds for a couple of treatments.

Marion Hale.

New York, N. Y.

* * *

Sirs:

Why, oh why, oh why, must you use such asinine articles as Mr. Willard G. Van Name's article on "Treatment for Ivy and Sumac Poisoning?"

It seems to me that before you expose thousands of children to boiled extremities, torsos, etc., you should check articles dealing with technical information.

Any modern textbook on contact dermatoses would tell you to first get rid of the irritant factor, which in the ivy group is an oil. Heating the oil will not decrease the irritant factor, but will merely spread the oil over a greater area.

In all respect to the writer, soaking in hot water may help dissolve oil from the skin. Heat or cold, as any therapeutist will tell you, will decrease the sensitivity of the nerve endings, but that does not indicate it is therapeutically of value in the ivy oil dermatitis.

So, Mr. Editor, if you will advise your reading public to use the following procedure, more satisfactory results will be obtained: In an ivy dermatitis, first get rid of the irritant oil by using an oil solvent such as benzine, naphtha gas, ether, etc. Follow this by washing with plenty of soap and water and rinse thoroughly, then treat the irritated skin as a first or second degree burn, whichever it is, with any of the standard burn preparations. . . .

Otto S. Hult, M.D.

Gladstone, Michigan

* * *

Sirs:

I have read with much interest, for many years, the Magazine. I would not be without it. In the April, 1946, issue is an article "Treatment for Ivy and Sumac Poisoning," written by Willard G. Van Name. He tells of what he has found to be the quickest and most effective treatment for this type of plant poisoning. Here, in the edge of the tropics, there are many plants that are poisonous. We found ten or twelve years ago that the quickest method of eliminating the skin eruptions caused by contact with poisonous plants, including poison ivy, was the application of hot water with a bath rag. I do not know who suggested it to us, but it is strange to me that so many people continue the slow method of using calamine solutions and household ammonia for such poisons when, within 24 hours, these poisons can be completely eliminated by the use of hot water.

B. J. Kincaid.

Miami, Florida

* * *

Sirs:

I read the article on the treatment of Poison Ivy and Poison Sumac and I thought you might be interested to know that both of these distressing poisons are cured in from 24 to 48 hours by rubbing the affected parts with liberal quantities of kerosene, about every three hours. . . . After a couple of applications, the poison is killed; itching and burning stop almost immediately.

If the case is an advanced one, in which sizeable blisters have already formed . . . the blister should be burst by pressure. The liquid is pressed out, and the kerosene is used freely about every two hours. The burning and itching will stop within a very few minutes, and even these severe cases will be completly cured within about 48 hours. . . .

Dr. George W. Miller.

Westport, Connecticut

* * *

Sirs:

In August, 1939, I decided that, since I had never tried ammonia and alcohol for poison ivy, I would do so. Equal volumes of strong water of ammonia (25% to 28%) and absolute ethyl alcohol were mixed and applied. Relief from the itching was immediate, and healing started . . . This treatment has never failed. One good application will nearly always suffice.

Keep the mixture on hand in a glass bottle tightly corked, as it otherwise loses its strength.

The mixture is very pungent and irritating to the membranes of the eyes and nose, and very painful if a drop should get in the eyes. Apply it freely with a clean cotton or linen rag . . .

Poison ivy sometimes causes small, hard, itching lumps, not blisters. In such cases it may be necessary to repeat the application. Do not rub this solution in too well, as it may cause a rather heavy scab, which does no harm but remains for some time. Do not rub off such scabs; let them come off naturally.

Charles Morris Johnson.

Avalon, Pittsburgh, Pa.

* * *

Sirs:

I take a quart milk bottle, fill it about half full of water, put in ten teaspoonfuls of carbolic acid, and then fill the bottle up with water and shake it. Then I swab and bathe the affected areas with this solution. It removes the terrible itching instantly. After a while the itch comes back and you swab it some more. After a number of days the poison ivy dries up and goes away.

For sunburn, I have found that the most effective thing is a quart of water and two teaspoons of carbolic acid. This is not a sun tan oil or anything of that sort. It instantly takes all the burn and sting out . . .

Since it is not greasy or shiny, women like it. Clothing can be put on immediately after applying it . . .

May I add that citronella oil seems to be ineffective against mosquitoes, but if you use oil of lavender, the mosquitoes apparently stay away.

W. Wallace McKaig.

Cumberland, Maryland

* * *

Sirs:

Regarding ivy and sumac poisoning, my daughter is extremely susceptible to it and has tried all remedies she has heard of, including epsom salts. Last fall, in desperation, she bathed her arms in vinegar and her sufferings were over. She had found her cure. . . .

May I congratulate you on Mr. William H. Carr's article, "As the Grass Goes," in the April Natural History? Too much cannot be said and published on the conservation of grass and all the other bountiful gifts of nature. The photos and similar ones should be shown in the movies. All the other articles were enjoyed as usual, particularly Mr. Neff's "Reaching for the Moon."

A. C. Kenly.

Chestertown, Md.

* * *

Sirs:

Mr. William H. Carr's article, "As The Grass Goes," in the April Natural History presented a true picture of what has happened on some, not all, of the National Forests in the West, but made it appear that the cattlemen were largely, if not wholly, to blame.

In view of the fact mentioned by Mr. Carr that such forests as the Tonto in Arizona, and many others, have been completely under the control of the Federal Government for more than 40 years, some of your readers may have wondered just why their deterioration was all the cattleman's fault. Mr. Carr indicates that

Continued on page 294

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HANDBOOK OF LIZARDS

- - - - - - by Hobart M. Smith

Comstock Publishing Company, $5.75
557 pages, 135 plates, 136 figures, 41 maps

ONLY one of them is venomous, some of them lay eggs, and some of them give birth to living young. One of them looks superficially like an earthworm, and spends virtually all of its life underground. A few of them run on their hind legs not unlike some of their distant dinosaurian relatives, and still others are equipped with adhesive pads on their toes that enable them to run over smooth surfaces. The fastest of the lot races over the desert sands with speed exceeding that of any other American reptile, and another one occasionally squirts blood from the corner of its eye when it is picked up. Such astonishing attributes may not be fascinating to everybody, but they mark the lizards as one of the more interesting groups of reptiles.

Despite this fact, the amateur naturalist has neglected the lizards largely because they were not easily identified. The publication of this Handbook will remedy the situation, and it is sure to stimulate interest in this neglected group of reptiles. Not that it merely enables the student to place a name on his specimens. That is the beginning, to be sure, but that answers only the first question: What is it?

Where does it live? What does it do, and how does it do it? Any inquiring individual wants these questions answered also, and if he doesn't find all the information he wants in this Handbook, at least he will find himself on the right track. It would be stretching a point to say, as it does in the blurb, that the bibliography includes "all the important literature in the field." A handbook cannot be an exhaustive treatise, but for the most part this one will fill any reasonable needs. The accompanying maps will be extremely useful even though a few are inaccurate, and in one instance a name used in the text does not agree with that on the map. The author is confused in his statement that the "tongue detects airborne odors" since it serves only to carry odorous particles to the organs of Jacobson (in the roof of the lizard's mouth) which function as accessory organs of olfaction, or smell. Other minor errors have crept in, inevitably, but naturalists will welcome the *Handbook of Lizards* as the first extensive treatment of the 135 species and subspecies found within or near the borders of the United States.

C. M. BOGERT.

VOLCANOES NEW AND OLD

- - - - - - by Satis N. Coleman

John Day Press, $3.75, 222 pp. 97 illust.

THE sight of Parícutin in eruption, especially in the early days, is inspiring enough to make others less gifted than Miss Coleman resolve to learn what man knows about these impressive spectacles. This, the second book on volcanoes for popular consumption in the past few months, admittedly owes its being to the sudden appearance of the now three-and-a-half-year-old monster in the cornfields of Dionisio Pulido, in February, 1943. Both books cover about the same ground, except that this starts with a recital of the tale which has been widely accepted about the events of the early history of Parícutin. The other (Jaggar's *Volcanoes Declare War*) is written by a world famous volcano authority; this by a successful author of works on music. Both leave something to be desired. Where the former is authoritative, it is difficult to read; this is by a writer who admits that her experience is limited, readable as she has made the book. If Miss Coleman errs, it is largely through non-critical reading of other writers.

After describing the appearance and early history of Parícutin, the author goes on to other volcanoes all over the world, and tells in an interesting way the highlights of their careers. The illustrations and appearance of the book add much to its attractiveness. There has been little available on the subject of volcanoes in recent years. By amassing the scattered accounts and bringing them together to give a world picture of volcanic activity, Miss Coleman has made them readily available to the casual reader. This is a great service, and justifies the book and its publication. However, the repeating of other accounts, without a true ring of any personal experience, leaves one with the feeling that *the* book on volcanoes still remains to be written. It is amusing to see a publisher restricting others from quoting from a book largely made up of quotations and paraphrases. However, it is well done; the illustrations are excellent, and the summary of the world's recent volcanic history gives a better picture of the significance of the Parícutin studies, in contrast to the offerings of the rest of the world, than a reading of the Parícutin accounts alone would.

F. H. POUGH.

CARL RUNGIUS. Big Game Hunter. Fifty Years with Brush and Rifle.

- - - - by William J. Schaldach

The Countryman Press, West Hartford, Vermont, $17.50
117 pp. Quarto

THIS is an exceptional book, a well-written biography of a big game painter, and a high class example of fine printing.

Carl Rungius is well-known to a wide circle of sportsmen, lovers of the out-of-doors, and admirers of the fine arts. To see a Rungius painting is to become possessed of a longing to own it. Mr. Schaldach, the author, is a talented artist in his own right, and this enables him to write understandingly of an artist's career. Furthermore, he has a love of nature and an admiration for his subject which leads him to write with conviction. The author presents a conventional biography relating the boyhood and early life of Rungius, his education and years spent in Europe, his visits to America, and his final decision to move to a permanent home in the States. The artist was well-schooled in the traditional preparation for his career, and to this he added greatly by his frequent trips into wilderness areas, studying his animals in their chosen environment, shooting them, measuring them, and overlooking no opportunity to add to his direct, personal observations. He became an unusually gifted big game hunter, and he paints with fidelity because he knows his subject so well. His firsthand knowledge of environments adds to the realism of his art. The animal and the background belong together, because that is where Rungius found them.

A substantial part of the text is composed of Rungius' own words. The author quotes the artist's personal account of many interesting incidents that arose when he was hunting and painting in Wyoming, the Yukon, New Brunswick, and the Canadian Rockies. These are the simple, straightforward stories of an unassuming man, but they outline an outdoor experience that any sportsman would envy.

The book has fine illustrations ranging from color reproductions of paintings and black and white etchings and drawings to half-tones of photographs. This is a volume to read for enjoyment and appreciation. It is also a continual reference for sheer admiration of artistry in illustration and fine book-making.

Harold E. Anthony.

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of the strange
creatures who once
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BORZOI BOOKS

Electrons in action

by James Stokley

Whittlesey House, $3.00
320 pp., 32 plates, 55 figures

THE secrecy that enshrouded the marvelous achievements of the physicists during the war years is beginning now to be lifted, and through the medium of such works as this, the general public is invited to a preview of tomorrow. The accomplishments of the scientists have suddenly been dramatically thrust into the forefront of world consciousness, but the world appears regrettably lagging in its willingness to accept the facts and guide its future course of action accordingly. The more that books like this are written and the more widely they are read, the sooner will thinking people be prepared to recognize an existing situation which they must accept and dominate; otherwise technological achievement may turn like a monster and destroy all mankind.

Mr. Stokley's book discusses so many different electronic activities that it cannot be read in a single sitting lest long waves and short waves, induction heaters and electron guns become so garbled that they give one a case of high frequency indigestion. If one wants to know the principles of radio, television, the electron microscope, x-rays, radar, the sources of the sun's energy, atomic fission bombs, fluorescence, induction heating, and spot welding, he will find them explained here. At the close we find a summary of the Smyth report, shorn of much of its redundancy, but retaining the essentials of the process of plutonium manufacture and utilization.

The illustrations are excellent, and many of the diagrams are borrowed from most authentic sources. The photographic plates, too, add greatly to the clarity of the text and the appearance of the book. Mr. Stokley has a background that qualifies him to write accurately on the many phases of electronic activity, and he has done a good job of putting together the only slightly related, infinitely varied uses of electron movement. As a readily understandable reference book it can be highly recommended, though we may doubt if electrons will ever become the popular heroes of a "whodunit" minded public. It is not easy reading, but the future of man and the world is, perhaps, worth a little concentration.

F. H. Pough.

THE LAND RENEWED—
The Story of Soil Conservation

by William R. VanDersal and Edward H. Graham

Oxford University Press, $2.00
109 pages, 60 photographic illustrations, mostly full page

IF a fraction of the national uproar over the scarcity of nylon hose could be directed toward desperately needed propaganda for the preservation of our vanishing soil, much good would result. The authors of *The Land Renewed* have earnestly and successfully presented a well-balanced picture of what is happening to our country through improper land usage. They indicate that unless steps are taken to stop soil waste, the future for our economy is very dark. They also state that we must arouse a national consciousness, an awareness of the very serious problem that confronts all of us today as a result of selfish, unthinking soil exploitation.

The authors point out that the food we all eat is only as good as the soil that produces it, and that we do little to replace nutritive values removed. Practically all our clothes and innumerable other items of human necessity also come directly or indirectly from the earth. Yet we strip millions of acres of fertile, irreplaceable top-soil, watch it muddy our rivers, observe its departure as heavy rains bear it away, permit our cattle to destroy the grass that binds it in place, and generally behave as though we believed soil to be inexhaustible.

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"Things we value most we must work to keep. So it has been with freedom. So it is with the soil that provides us all with food. Only so long as America uses it soil with care and respect can it remain a great and powerful nation." With this thesis the writers of this little book have proceeded, step by step, to show the ills and the remedies. Carefully selected photographs, each accompanied by a full page of pertinent text, carry the reader from considerations of adequate land management through proper planting of farmlands to the safe usage of cattle ranges. There are excellent accounts of steps to be taken to prevent soil erosion. This is a valuable primer that should be thoughtfully read by everyone interested in the future welfare of the United States.

William H. Carr.

ASTRONOMY
What Everyone Should Know
- - - - - - by John Stuart Allen

The Bobbs-Merrill Company, $2.50
199 pages, 32 photographs, also drawings

THIS very readable and interesting book is one of the Bobbs-Merrill series of "What Everyone Should Know" books, a companion piece to the volumes on Aviation and Plastics. Dr. Allen, who is Director of the Division of Higher Education of the New York State Education Department, presents his material in an admirably clear and untechnical manner. It is easy to see that Dr. Allen has had long experience in teaching, for he succeeds in explaining difficult concepts with great simplicity.

Dr. Allen's book is decidedly for the beginner or for those who know just a little about the pleasure involved in studying the interesting science of astronomy. It is well illustrated with drawings and fine photographs.

Astronomy: What Everyone Should Know is divided into seven main sections, entitled (1) The Sun's Family, (2) Constellations, (3) Telescopes, (4) The Moon, (5) "Shooting Stars," (6) Real Stars, and (7) Skyrocketing Through Space.

This is a very pleasant book for the person who wishes to know enough about astronomy to be able to talk and think intelligently on the subject, and yet who does not wish to go into any of the material exhaustively. The general make-up, which includes clear and sometimes amusing diagrams, adds much to the book's popular value.

The chapter on *Constellations* is divided into seasonal groups, and is illustrated by line drawings of the individual star groups. The section on *Real Stars* gives to the beginner a good idea of the methods used by the astronomer in determining the real nature and characteristics of the stars, as well as interesting and understandable data concerning the stars themselves.

This is an excellent book to place in the hands of anyone who has expressed an interest in the stars and other heavenly bodies.

Marian Lockwood.

A NATURALIST'S SCRAPBOOK
- - - - - - by Thomas Barbour

Harvard University Press, $3.00
208 pages, 19 plates

"A SENTIMENTAL old codger" the author of this book calls himself, but it was more than sentiment that led him to build the Museum of Comparative Zoölogy into one of the finest research institutions of its kind. "T.B.," as he was affectionately known to his colleagues until his death in January, 1946, decided to become a naturalist even before he entered Harvard as an undergraduate in 1902. He was Curator of Reptiles from 1910 until 1927, when he became Director of the Museum. Never an armchair naturalist, at the age of 22 he took his bride to the East Indies on their honeymoon, as he describes in his chapter on the Spice Isles in this *Scrapbook.*

Despite his administrative duties he managed to spend a few months in the field every year until ill health imposed restrictions. When his physical condition made it difficult for him to venture into the field toward the end of his career, he sought his pleasure vicariously by recalling incidents of the past. These he set down in a series of essays published in four books, *A Naturalist at Large* (1943), *That Vanishing Eden; A Naturalist's Florida* (1944), *A Naturalist in Cuba* (1945), and the present *Scrapbook.* With the zest characteristic of previous volumes, this one covers a variety of subjects, ranging from his views on research and exhibits in museums to zoögeography, and the characteristics of animal populations on oceanic islands.

Throughout, the book is sprinkled with anecdotes, concerning not only important scientists with whom "T.B." associated, but with the foibles of museum curators and administrators. But mostly the book centers around the Museum of Comparative Zoölogy and Dr. Barbour's efforts to build its collections to represent the fauna of the world, insofar as limited storage facilities permitted.

Commenting on the financial handicaps under which the museum labored, Dr. Barbour makes the following statement, with which this reviewer cannot agree: "This handicap has really been a benefit to the museum. No one has ever sought employment here for the sake of salary." Actually the educational institutions that maintain the best research staffs pay the top salaries.

C. M. Bogert.

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BONES *in th*

A Paleontologist's Rendezvous with History and Prehistory in St. Louis

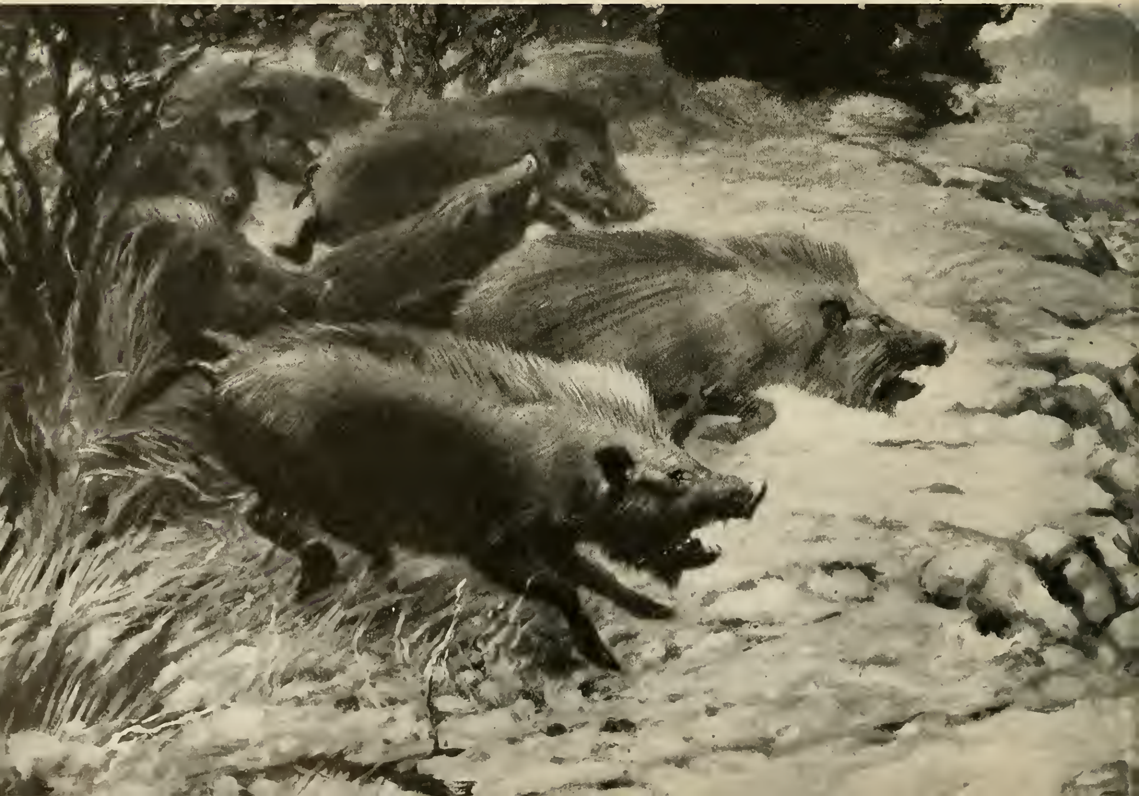
THREE currents of history meet at the corner of 13th and Cherokee Streets in St. Louis, Missouri. South of Cherokee, where 13th does not run through, there is now an immense shoe factory. On the northeast corner of the intersection, there is a large but apparently rather plain brick house. The northwest corner is a lot with only one small structure, which looks like a one-car garage. Each of these buildings is more than it seems to be because each has a historical significance. The shoe factory was formerly a brewery: it recalls a current of history that started in the Rhineland, more than a century ago. The house turns its plain side to the street but when viewed from the east, within its own spacious grounds, it is seen to be a stately mansion with a graceful, pillared portico: its history traces back through the De Menils and the Chouteaus to the pioneer days of the Mississippi. The apparent garage is really the entrance to a cave that rambles beneath the surrounding buildings: its history is the most ancient of all, and in it are buried animals that lived before man ever saw the site of St. Louis.

Our introduction to this convergence of history at 13th and Cherokee Streets began with a letter. Lee Hess, a pharmaceutical manufacturer in St. Louis, wrote to say that he had found some bones in the cellar of a brewery. Would the Museum be interested? Many such letters come to a curator's desk. Nine times out of ten, they do not lead to anything of value, but we always follow them up as far as possible because the tenth letter may be a clue to an important scientific discovery. We wrote to Mr. Hess asking him to send some of the bones so that we could determine their possible importance.

The bones sent to us had been

▼ EXTINCT PECCARIES (*Platygonus compressus*) of the type that once roamed the pre-St. Louis countryside. A restoration by Charles R. Knight

A.M.N.H. painting and photo



BREWERY

By George Gaylord Simpson*

Curator of Fossil Mammals and Birds,
The American Museum of Natural History

considerably broken by the workmen who found them, but when we pieced them together in the laboratory we found that they included a skull of an extinct peccary, *Platygonus compressus* by name. Now, *Platygonus* is not a particularly rare fossil. Its remains had already been found in many places throughout the United States. For instance, 22 skulls (12 of them nearly complete) had been collected for the United States National Museum in a cave near Cumberland, Maryland, 5 partial skeletons had been found in a peat bog near Belding, Michigan, and 9 nearly complete skeletons had been discovered at Goodland, Kansas, in the clay-pit of a brickyard, and sent to the University of Kansas. One of the Kansas skeletons, obtained from the University by the American Museum of Natural History, was restored and mounted in a lifelike pose and has been exhibited here for years.

In spite of these and other previous discoveries, we became quite excited about the bones from St. Louis. *Platygonus* had never turned up in a beer cellar before, and extinct animals are rarely found in the heart of a great city. How they came to be there was a mystery worth solving, and we resolved to go to St. Louis and try to clear up the mystery with a little geological detective work. I wrote to Mr. Hess asking whether more bones remained in place and whether we could come out and investigate the find. His reply assured us that many bones remained to be excavated and cordially invited us to study the occurrence. In a few days George O. Whitaker, of our fossil vertebrate laboratory, and I were off for what turned out to be an unexpectedly fascinating rendezvous with history, ancient and recent.

Photo from Lee Hess

▲ Expedition headquarters: the fine old De Menil house, a historical landmark standing near the entrance to the natural caves beneath St. Louis' 13th Street and Cherokee

Mr. Hess met us in St. Louis and drove us immediately to the De Menil mansion, the historic home at 3352 South 13th Street. This house, unoccupied but restored by Mr. Hess with sufficient modernization for comfort, was our camp throughout our stay: a camp such as a bone-digger has seldom enjoyed in his wildest dreams of luxury. Before we were through, it was also our bone laundry, shellackery, and packery. Here we dropped at once into an atmosphere of old St. Louis of the pioneer days before the Civil War. The house was originally built in the 1840's by Henri Chatillon, a western guide and hunter of that period. In 1854 it was purchased by Dr. Nicholas N. De Menil, and in 1863 he enlarged it by adding several spacious rooms and the magnificent portico on the east side, overlooking his large garden and the slope of Arsenal Hill down to the Mississippi.

Nicholas De Menil, who had come to America on a visit (which proved to be life-long) in 1833, was a physician who established the

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*George Gaylord Simpson had youthful ambitions to become a man of letters, but a geology course at the University of Colorado awakened his interest in bone-digging and eventually led to his following that career. In 1922 he transferred to Yale, where he completed his undergraduate work in 1923 and received his doctorate in 1926. After a year abroad as a National Research Council fellow, he came to the American Museum as an assistant curator in 1927, where he has remained ever since, except for a period of military service in 1942-1944. He became Curator of Fossil Mammals in 1942 and Chairman of the Department of Geology and Paleontology in 1944. He is a fellow of the National Academy of Sciences and of the American Philosophical Society, president of the Society for the Study of Evolution, and past president of the Society of Vertebrate Paleontology. He has written more than 200 scientific articles and books. In 1934 the field diary he had kept of his experiences in Patagonia as leader of the first Scarritt Expedition of 1930-1931 gave fruit in his lively and fascinating book, *Attending Marvels*.—Ed.

St. Louis Post-Dispatch photo

▲ THE AUTHOR, assisted by George O. Whitaker, also of the American Museum, digging for prehistoric animal bones in the cave. For many years the cave was used for the storage of beer and as an entertainment center, without anyone suspecting that it contained remarkable scientific treasures

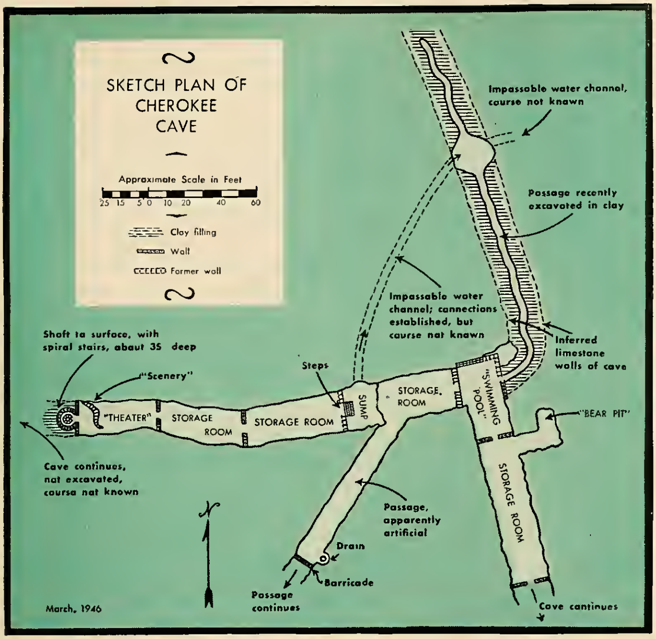
first successful chain of drugstores in St. Louis and became one of the aristocrats of that growing center. He married Emily Sophia Chouteau, linking his family with the real pioneers of the region, for she was the great-granddaughter of Marie Therese Chouteau, the first white woman to settle in St. Louis and still revered as the mother of that city.

Alexander De Menil, son of Nicholas, lived in the house throughout his long life. By the time he died, Arsenal Hill was no longer a swanky residential district but had been overgrown with smoky factories and surrounded by slums. His heirs chose not to live there, and the property finally passed out of the family when they sold it to Mr. Hess, almost a century after the family acquired it. Like his father, Alexander was a physician, but he was also interested in literature and became a poet of local renown. Among his voluminous productions is a rather quaint but forceful defense of his great-great-grandmother, the famous Madame Chouteau. (She left her husband in New Orleans because of his cruelty to her and formed an irregular union with Laclede, who became the founder of St. Louis; her solution of a marital problem when divorce was impossible was approved by her contemporaries, but became a worry to some of her descendants.)

We often thought of these vanished occupants as we roamed through the house or rested on its spacious balconies and watched spring come to the garden. If, however, the ghosts of the Chouteaus and the De Menils roamed through the house at night, we never knew it, for we slept soundly after our hours of bone-digging. Ghosts still more exotic might conceivably have troubled our slumbers. The fascinating hodge-podge accumulated by Mr. Hess with a view to future exhibition included a reconstruction of a Damascus palace with its furnishings. After display at the St. Louis fair in 1904, these oriental trappings had been crated and stored until recently when our host acquired them and piled them into the De Menil house. Thus it happened that our library included an Arabic Bible, along with Hedin's *My Life as an Explorer*, the Catholic Directory, Boccaccio's *Decameron*, and *How to Develop a Winning Personality*. Pending the availability of more space and the sorting of all these treasures, our quarters were furnished in a medley of styles in charming confusion. Tubular metal modernistic chairs jostled a mid-nineteenth century *chaise longue*, over which was thrown a vivid Mexican serape and beside which was an old Turkish tabouret of ebony inlaid with mother-of-pearl. The introduction of our prehistoric peccaries struck no jarring note but seemed only to complete this remarkable mixture.

History and pre-history

It was, after all, the prehistoric peccaries that had called us here and that claimed most of our attention, but even these brought us into contact with history as well as with pre-history. Unrest in the Rhineland well over a century ago was one of the influences that led to our journey to St. Louis last March and to the exhuming of these ancient remains. It was in the 1820's that one Gottfried Duden came to the Mississippi Valley to spy out the land for his German neighbors. Here in St. Lous he found several caves in the limestone underlying


SKETCH PLAN OF CHEROKEE CAVE
Approximate Scale in Feet
25 15 5 0 10 20 40 60
Clay filling
Wall
Former wall
Shaft to surface, with spiral stairs, about 35 deep
"Scenery"
"THEATER"
STORAGE ROOM
STORAGE ROOM
Steps
SUMP
STORAGE ROOM
"SWIMMING POOL"
"BEAR PIT"
STORAGE ROOM
Cave continues, not excavated, course not known
Impassable water channel, course not known
Passage recently excavated in clay
Impassable water channel; connections established, but course not known
Inferred limestone walls of cave
Passage, apparently artificial
Drain
Barricade
Passage continues
Cave continues
N
March, 1946

the city and he reported that the site was propitious for breweries. Before the coming of artificial refrigeration, successful brewing on a large scale required natural repositories where the temperature was constant and low throughout the year. These caves, which retain a temperature near 55° regardless of the weather outside, were ideal for the purpose. Rhineland brewers migrated to St. Louis and converted the caves into storerooms for their lager. It was one of these immigrants, Adam Lemp, who cleared out the cave at 13th and Cherokee and built his brewery above it.

Toward the end of the nineteenth century, air-conditioned storehouses made the caves unnecessary, and they were abandoned by the brewers. One or two were converted into underground beer parlors and places of amusement: Uhrig's Cave was such an establishment in the gay 90's and is nostalgically remembered by St. Louisians. But the cool, dark dampness of the caves, so suitable for beer before it is drunk, seemed to depress the customers after they drank the beer. "Uhrig's Cave" became an open air theater above the actual cave. The cave itself enjoyed only one more brief flair of fame when a large distillery was discovered in it during prohibition. The other caves were closed, their entrances walled up or blocked with debris, and eventually they became vague memories. The Lemp Brewery went out of business during prohibition, its buildings were sold to the International Shoe Company, and its cave, the Cherokee Cave, was forgotten until Lee Hess recently conceived the idea of reopening it as a site of historical and geological interest.

When we arrived, we took only a quick glance at the noble De Menil mansion ("our puptent," George called it), and then hurried down into the cave. A circular, brick-lined shaft about 35 feet deep had been reopened and a spiral iron staircase installed. At the foot it opens into a long series of storage rooms, once full of lager beer but now dismally empty. The rooms were formed simply by clearing out a natural cave, a former underground river channel within the solid limestone, and by dividing it by masonry walls. The first room at the bottom of the shaft still bears traces of its use for private theatricals and parties by a gay blade of the Lemp family who took it over when the beer was moved out. Across one end he constructed artificial scenery made of wire screen and plaster. The scenery represents a fair imitation of the wall of a cave; this hiding of a real cave wall behind an artificial cave wall is one of the touches that made us feel at times as if we had stepped into Alice's Wonderland. There are still remains of the crude but serviceable floodlights used to illumine this scene.

The cave extends in an easterly direction for some 200 feet beyond this "theater." There it is joined by another channel, coming from under the former brewery to the south, also cleared and converted into storage rooms. At the intersection is a concrete-lined pool, presumably used as a reservoir in the old brewing days and reputedly used as a swimming pool in the later (but now also old) days of theatricals and parties, although we thought that a party would have to be very stimulating, indeed, to tempt us to plunge into those Stygian waters!

Where no man has been

This was the end of the cave so far as the brewery was concerned. It terminated here with a masonry wall. To see where it went beyond, Mr. Hess had the wall broken down with a hydraulic jack and was disconcerted to find that although the cave does, indeed, continue, it was almost completely filled by a deposit of stiff, wet clay. This made it impassable for anything much larger than a rat. He had workmen dig a narrow passage in the clay, following the ancient channel of the cave. Within 20 feet from the wall it turned to the left, northward, and had, at the time of our visit, been followed in that direction for some 200 feet farther, with no sign of ending, or of coming out to the surface, or of joining another, adjacent old brewery cave (the Minnehaha Cave) with which Hess hopes eventually to make a connection. The point where the cave turns is almost under the porch of the De Menil house, where we used to relax at lunch or in the evening, 40 or 50 feet straight above our diggings.

A more talented and imaginative writer might contrast these superposed scenes in a sort of allegory. In the upper world it is spring. The air is warm and balmy, and the sun is shining. The grass is green and sprinkled with violets. Bushes and trees are in bloom, and innumerable birds are setting about their seasonal loves and labors. The caretaker's pretty baby girl toddles about, learning to walk. The world of life is developing its future in a scene just old enough to be leisurely and pleasantly mellowed.

In the lower world there are no seasons. The motionless air is always cool but never cold. The humidity is always near 100% and nothing is ever quite dry. The white limestone ceiling is dewey as if perspiring quietly, and water drips slowly from the tips of the scattered stalactites. The water is limpid but it carries in solution minute quantities of lime, the slow, imperceptible precipitation of which through the ages has formed the stalactites, stalagmites, and cave onyx, all forms of what has appropriately been called dripstone. Yellow lights illumine a scene that has never known the sun and make temporary islands of light in a sea of absolute darkness that has been lightless for hundreds of thousands of years. Smeared from head to foot with yellow mud, workmen slide along the narrow passage, digging out the sticky clay, penetrating still farther into the mysterious entrails of the earth where man has never been before. In spite of this rash intrusion, the strange scene seems as ancient and timeless as a tomb. And it is a tomb, a place of mass burial, sealed away as a monument of the dead past, before the first Indian ever hunted a deer along the top of the hill inside which it lies.

A nice find

That filling of clay is an exasperating and expensive nuisance to the men who want to reopen the old cave channel, but it is a delight to the bone-digger. It was in this clay that the workmen found the bones that brought us to St. Louis, and we began finding more bones as soon as we dug into it for ourselves. In the week that we were there, we found too many bones to count, but we guess that we excavated between 2,000 and 3,000 of them, some almost too small to see while others were large, complete skulls.

As we dug bones, we began our detective work. What the bones are is perhaps the least part of the mystery, and their identification had to be done back in New York, anyway, where we could study and compare the bones at our leisure. Here the problem was how the bones came to be here, in the core of Arsenal Hill under the De Menil house. Some clues are still missing and a more fortunate detective than I may prove someday that I am wrong, but we did soon find enough clues for a tentative solution of the mystery.

As Clue No. 1, there is the cave itself. By that I mean the long, branched, channel-like cavity in the limestone, regardless of the fact that it is or has been nearly filled up with clay. It averages 20 to 25 feet wide, with solid limestone walls and ceiling. We do not know how long it is, where it comes from, or where it goes to: important missing clues. We do not even know how deep it is or what the floor is like, because as deep as anyone has yet dug (12 to 15 feet in places), the bottom of the clay has not been reached.

Clue No. 2 is the clay, or rather, this is a series of clues, because the clay proves on investigation to be complex and to include several distinctive superposed layers. The lowest layer visible, as far as it has been excavated, is massive, yellowish gray, and somewhat gritty. We found no traces of bone in this. At its top in some places but not in all is a layer of dripstone (cave or "Mexican" onyx) from which rise stalagmites, buried by the overlying layers of clay. The next higher clay layer, sometimes absent but in other places two feet or more thick, is very smooth and fine, without grit, and is deposited in thin, horizontal layers. There are no bones here, either, except occasionally right at the top where they probably sank in from above when the clay was less compact. The top of this is sharply distinguished from the overlying bed but it has no layers of dripstone so far as we saw. Next higher is a bed of clay quite variable in thickness but averaging 18 to 20 inches, also fine and plastic, but without layers and containing many scattered chunks of limestone and of dripstone. Almost all the bones are in this bed of clay, which we called "the peccary layer." Above it there is occasionally, but not usually, a thin layer of dripstone. At the very top is a bed, usually less than a foot thick, of relatively loose, granular, earthy clay. In places it fills holes extending down into the lower layers. A few very small bones were found in this bed. In some places where there is a small unfilled space above this top layer there are small stalagmites on it, and where these occur they are usually set on small plaques of dripstone.

Our major clues are the bones themselves, not only because of what they are but also because of how they occur. As I have said, almost all the bones are in the "peccary layer." You cannot dig long in any part of that particular stratum without finding bones, but they do usually tend to be more common toward the bottom of the layer. Even when several are found together, they are just piled up at random. No two bones of the same animal are found together. Most of the long bones are buried in a more or less horizontal position, but some are oriented without regard for the natural bedding of the deposit and they may even be vertical. Small, solid individual bones are usually whole, but the longer and more fragile bones are usually broken. We did not find a single complete rib. A few of the bones have tooth marks and had been gnawed before being buried here. Bones of the extinct peccary are by far the most common, but there are also a few bones and teeth of other extinct animals and of some living species in this layer; I will give the list later.

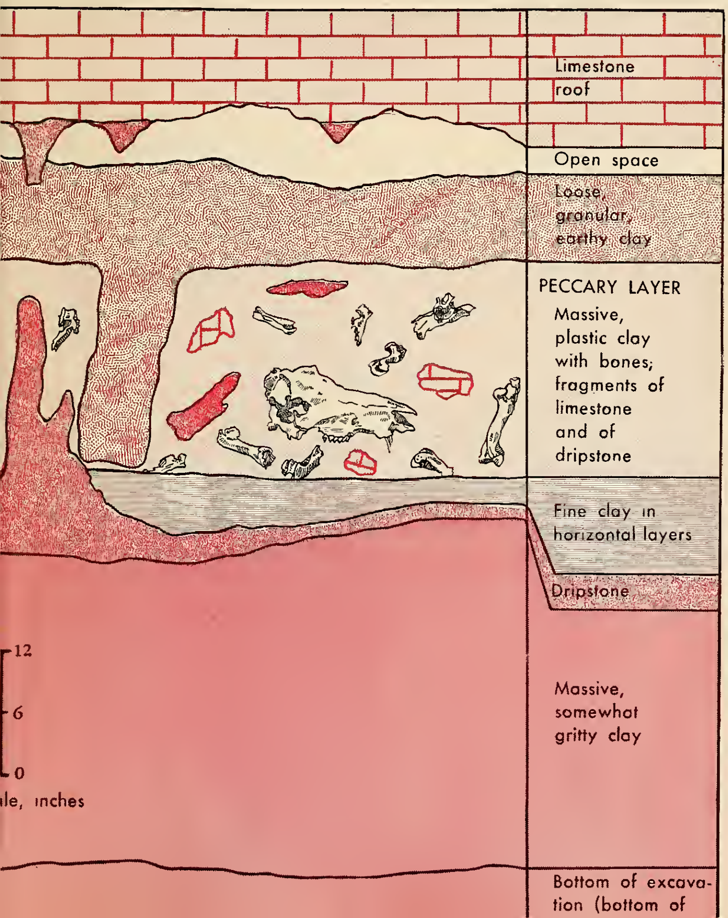
The rare bones in the highest layer tend to occur in a few pockets, scattered but sometimes with the remains of one individual near each other. Except for one or two bones apparently washed out of the peccary layer, there are no extinct animals in this bed and most of the bones belong to small, burrowing rodents.

The story of the cave

Those are the main clues. This is my proposed solution, so far as it has yet been carried:

The very first thing that left traces here happened so long ago that it is only indirectly involved in our problem of the bones. This was the deposition of the limestone, which occurred in a sea that covered this site about 300,000,000 years ago. Much later, perhaps only a million years or so ago (the event has not been very exactly dated, and it took a long time), the cave was formed. The sea had withdrawn long since and the region had been uplifted gently. Water began to percolate along the cracks and seams of the limestone and as it went, it slowly but steadily dissolved the rock. Eventually it formed a large underground channel which was, and is, the cave. At this stage the cave was free of any extensive deposits of clay, and it probably had a subterranean stream or river at the bottom. This probably reached the surface some distance away and eventually flowed into the Mississippi.

▼ THE GEOLOGICAL STORY of the cave before and after the animals lived in the region was deciphered from the cross section of the deposits that had partly filled it, as described in the article


Limestone roof
Open space
Loose, granular, earthy clay
PECCARY LAYER
Massive, plastic clay with bones; fragments of limestone and of dripstone
Fine clay in horizontal layers
Dripstone
Massive, somewhat gritty clay
Bottom of excavation (bottom of
12
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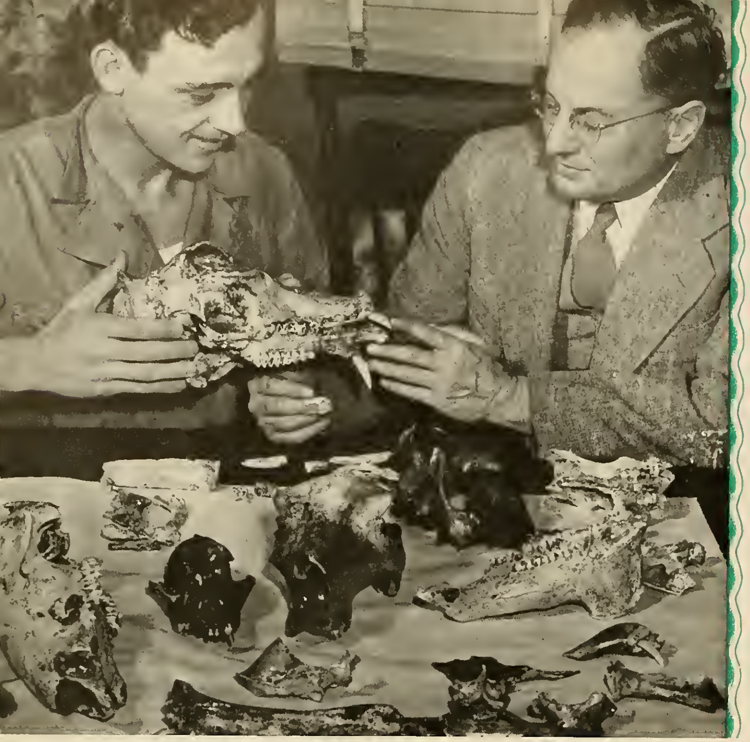
Somehow the exit from the cave became clogged and the clay and silt brought in by streams from the surface, instead of being washed on through the cave and out again, began to pile up in the cave. These sediments eventually filled the cave up to within a few feet of its ceiling. Then for a long time there was no particular activity except the slow dripping of lime-filled water within the cave, developing dripstone deposits here and there on the top of the silt which now formed the floor of the cave. This floor was not even but contained shallow depressions. The next recorded event, which probably occurred during a particular rainy period of the Ice Age, was the filling of these depressions with water, forming within the cave a lake, or a series of small lakes. Tiny, insoluble clay particles were slowly washed into this standing water and they accumulated at the bottom, forming the bed of horizontally banded clay that we found below the peccary layer.

Now came what is for us the great event: the deposition of the bones in the cave. The evidence shows clearly that these animals did not live or die in the cave and it strongly suggests that this was not the first place in which they were buried. The animals probably fell into a sinkhole or fissure somewhere near the cave, perhaps a hole that had been an entrance to the cave but had been sealed off from it by the older accumulation of clay or by a fall of rock. The exact spot has not been found and search for it would not be very hopeful now that the whole region has been built up as part of a great city. The bones of many animals, hundreds certainly and perhaps thousands, piled up in this sinkhole or fissure and were buried there in mud and clay that washed in over their bones. Then the accumulation—



St. Louis Post-Dispatch photo

▲ In the "field laboratory" in the De Menil house: George Whitaker and Lee Hess examine the skull of an animal that lived at least 20,000 years ago, during or shortly after the Ice Age. Mr. Hess discovered the bones on his property and invited the American Museum to excavate them

clay, bones, and all—was somehow washed into the cave. There are several ways in which this could have occurred. Perhaps the most likely is that the sinkhole or fissure filled up with water above the clay and bones, that this water found an outlet into the cave, and that it suddenly flushed the whole deposit into the cave and spread it out over the older clay deposits of the cave. The nature of the peccary layer in the cave suggests that it came there rapidly, perhaps in an hour or two —one dramatically rapid event in a sequence where most changes can only be measured in terms of thousands or hundreds of thousands of years.

After this sudden change, things quieted down again. A little more clay was washed in from time to time. Rodents occasionally wandered into the cave, rooted around a bit in the top clay, and died there. These later events did not matter much so far as our interests go, until the final event of the reopening of the cave by man. It is surprising that the discovery of prehistoric animals here was delayed until 1946. When the brewery cleared part of the cave, many tons of clay were removed and in this there must have been thousands of bones. So far as is known, no one paid any attention to them. Presumably they were carted off with the clay, dumped somewhere, and buried again: their third burial.

The bones that have now been recovered and saved for scientific study include all anatomical parts of numerous individuals of the extinct peccary, *Platygonus compressus*. Both sexes and all ages are represented, from tiny jaws of peccaries newborn, or perhaps actually not yet born when they died, to skulls of big, tough boars. North America was peccary headquarters for millions of years. Numerous extinct kinds have been discovered, and there are two kinds still living in South and Central America one of which, the collared peccary (*Tayassu angulatus*), ranges as far north as southern Texas, New Mexico, and Arizona. Peccaries are sometimes called "wild pigs" and they do look much like pigs, but the real relationship is not very close. They do not belong to the pig family (Suidae) but to a distinct family of their own (Tayassuidae). True pigs have never been native to the Western Hemisphere.

The living peccaries are rather small animals, seldom over 20 inches high at the shoulder. They usually run in bands and are inoffensive vegetarians, although their sharp, curved tusks give them a somewhat fierce appearance. Some travelers have told horrendous tales of being attacked by large bands of peccaries, but more reliable observers report that they will not attack except as a last resort when they are molested. The normal use of the tusks is to pull up and cut roots for food. Our extinct peccaries from Cherokee Cave had the same habit, because several of the tusks that we found have grooves worn in the sides from rubbing against gritty roots. In fact, these ancient peccaries must have looked and acted very much like their surviving cousins, except that they were about twice as large.

Other animals

We had hoped to find remains of other animals that lived at the same time as the peccaries, and in this we were successful, but only one of our additional discoveries was particularly striking. Apparently the trap in which these animals were originally buried, the sinkhole or fissure from which their remains were flushed into the cave, was specially adapted for catching peccaries. Few other animals fell into it, but we did find scanty remains of a black bear, a raccoon, and a porcupine, all much like those still living in the region when white men arrived there. The unexpected discovery was an extinct armadillo, related to the recent Texas armadillo but larger. This is an important new record, because St. Louis is much farther north than any other known occurrence of an armadillo, living or extinct. Recent armadillos range no farther northward than Texas, and the only comparable previous finds of extinct armadillos were in Florida.

Both the armadillo and the peccary, also a warmth-loving animal, suggest that when these animals lived there the climate of the region was milder than at present. They may have lived just before or just after the last glacial stage of the Ice Age, for these were times of relative warmth. Aside from this inference, it is impossible to give a very close answer to the question as to how old the bones are. The difficulty is increased by the fact that the bones were not originally buried where they are now found. They may have lain for a long time in their original tomb before being washed into the cave. They are pretty surely more than 20,000 years old, and it is not likely that they are more than 500,000 years old—the interval gives a good deal of leeway. In any case, they are very ancient in terms of human history but are quite young as fossils go.

Bones almost like new

Hermetically sealed in continuously damp clay since shortly after the animals died, the bones have been unusually well preserved. The marrow and other soft animal matter have decayed and disappeared, but the hard bone substance has not changed at all. The bones were roughly jolted when they were flushed into the cave and many of them were broken then, but even the fragments are strong and fresh and some of the unbroken bones look almost as if they were the remains of last night's pork roast. This beautiful preservation made the bone-digger's job much simpler and quicker than it usually is. It was not necessary for us to apply preservatives to the bones immediately on exposure or to encase them in reinforced plaster before moving them—procedures usually necessary with fossil bones. After carefully exposing them on one side, they could immediately be pried out of the clay without damage. The problem of cleaning them was also unusually simple. No slow grinding, scraping, and chiseling to remove the rock in which most fossil bones are buried. We simply soaked them in a wash basin for an hour or two and then scrubbed off the clay with a stiff brush.

With the help of Mr. Hess and the gang of workmen he provided, we developed a mass-production system in our bone-digging. The bones were piled up in boxes as we dug them out, and the full boxes were then taken up to the De Menil house, where we had what we called our bone laundry. Here, in the old kitchen, they were set to soak, and when the clay had softened sufficiently, they were thoroughly scrubbed. The clean, wet bones were then spread out to dry on tables in the dining room. Like fresh bones, they do tend to crack when dry; the fact that they had not been dry for thousands of years is a reason for their exceptional preservation. So the next step in the production line was to paint them thoroughly with thin white shellac and then to dry them again. The shellac soaks in sufficiently to seal all the incipient cracks and forms a transparent protective coating that will preserve them practically forever. Then they were ready for the last step and were moved on along the line into the parlor, where they were carefully wrapped and packed in boxes and barrels for shipment to New York. Between the cave and the mansion, our bone mine, laundry, shellackery, and packery hummed all day and sometimes far into the night. In only one week we had what would ordinarily be a good bag for a whole collecting season. Not only that, but nine-tenths of the bones were all ready for study or exhibition when we shipped them, requiring none of the usually tedious additional preparation in the New York laboratory.

So the mystery of the bones in the brewery was solved and a goodly sample of the bones moved on to the Museum by way of the De Menil house. De Menils and Chouteaus; peccary knuckles and beer; caves and palaces—these were some of the ingredients in a unique adventure in bone-digging. It was a curious mixture, so strange that at times we were hardly sure whether we were awake or dreaming. But as I write these last lines a peccary skull looks at me blankly, reassuring me that the fascinating medley of history and prehistory was real.

▼ THE SAME KIND of peccary that was found in unprecedented abundance in the cave: a specimen from Kansas on display at the American Museum

A.M.N.H. photo

Modern relatives of the extinct peccaries described in this article live in Arizona today. In a coming issue of NATURAL HISTORY, the story of a search for information about them will be told by William H. Carr, in "Wild Pigs of the Desert."—ED.

THE SECOND IN A SERIES ON THE
FLOWERS OF THE FOUR SEASONS

The LOTUS

▲"THE BLUSHING LOTUS lifts its fragrance to the air
And casts the reflection of its pink petals upon the water."
—*Su Shih* (A.D. *1036-1101*)

Translated by Helen Wiley Dutton and used with her permission

hinese Symbol of Summer

Inseparably connected with Buddhism and sacred to Taoism, the lotus is not only the symbol of summer but also the emblem of purity

By Mabel Irene Huggins

THROUGHOUT July and August, one of the most beautiful sights of Peiping is the lotus in bloom. This flower, which in North China is either pink or white, is held in such esteem that it has become the symbolic flower of summer and second member of the *ssu chi hua,* or "flowers of the four seasons."

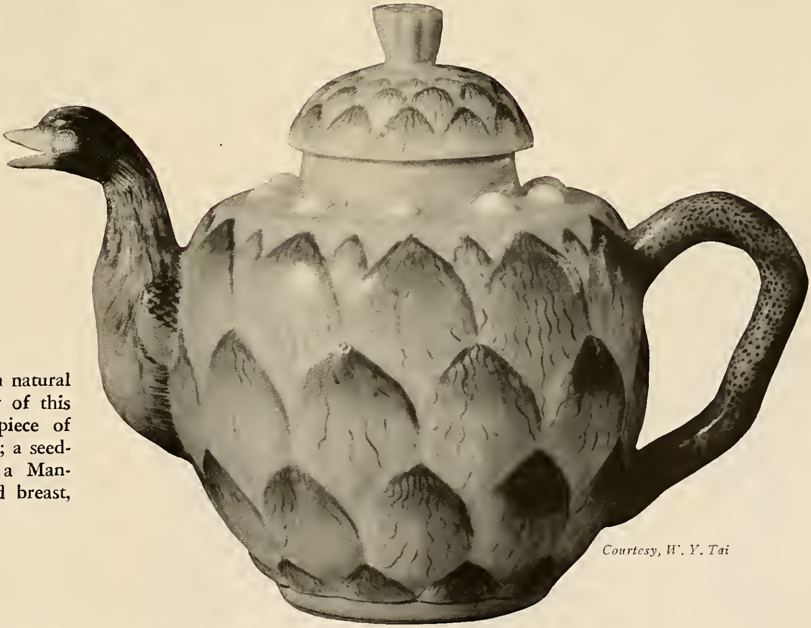
The Chinese call it *lien-hua* and speak of the pink ones as "red" or *fen-hung,* which means "powdery red." But according to the color standards of Westerners, they are a deep rosy pink. In spite of the mud and slime from which the lotus rises, it is characterized by a fresh and spotless beauty. Hence, it has also become the emblem of purity.

The best view of the lotus blossoms in the Imperial City is from the Bridge of the Golden Sea-Turtle and the Jade Rainbow, the magnificent marble bridge between the North and Central Lakes. Another fine showing of lotus stretches along the moat that surrounds the Forbidden City.

The lotus is inseparably connected with Buddhism. A story about Buddha says that once when he leaped from a rock, he was saved by landing on a lotus blossom in the pool below. He is usually portrayed in an attitude of meditation and seated on wide-open lotus petals, as are many other Buddhist deities.

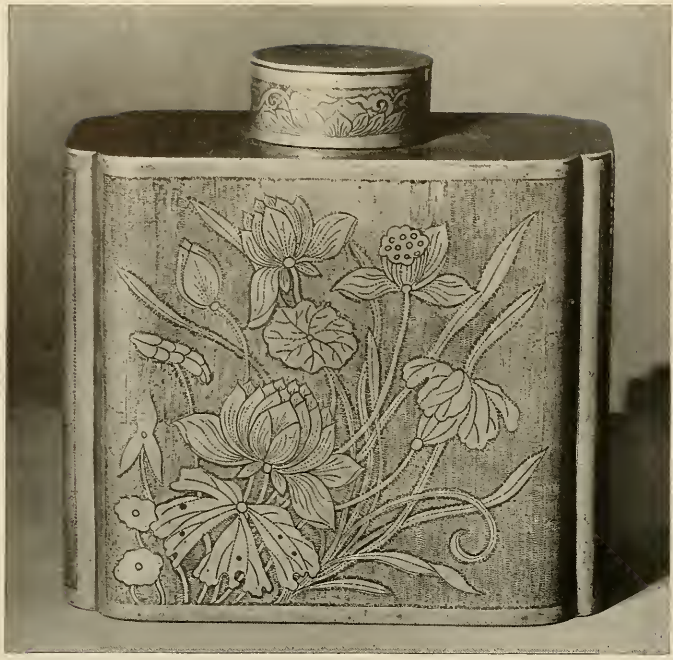
But Buddhism does not have a monopoly on the lotus, for it is sacred also to Taoism. One of the Eight Taoist Immortals, Ho Hsien-ku, is known as the patron saint of housewives. Her emblem is the lotus, and she is always shown carrying either a lotus flower or a lotus seed-pod. Sometimes, if it is the latter, the top has been removed, revealing peaches in the cuplike cavity.

Lotus leaves play a noteworthy role in the celebration of the Spirit Festival, which occurs on the fif-



➤ A LOTUS BLOSSOM in natural colors forms the body of this porcelain teapot. A piece of stem forms the handle; a seed-pod, the knob; and a Mandarin duck's head and breast, the spout

Courtesy, W. Y. Tai



Courtesy, Alice Margaret Huggins

▲ THE LOTUS in various stages of development decorates the front of this pewter tea caddy

teenth day of the seventh moon of the Chinese calendar. This is a kind of memorial day in honor of those who have been killed in action. In the evening countless lotus leaves are used as floating candle holders and placed on lakes or streams to light the way for the souls of the dead as they return to their abode in the spirit world.

The Chinese also raise lotus in large porcelain or stoneware tubs which are placed inside their entrance gateways or in their inner courtyards. Lotus pools which harbor pop-eyed, ruffle-finned goldfish are also popular in Chinese gardens.

With characteristic cleverness in making use of what other folk waste, the practical Chinese harvest the annual crop of lotus leaves and use them in place of paper sacks and wrapping paper. When I lived in Peiping, my Chinese cook usually came home from market with the meat and fresh fruit done up in leafy coverings. This idea should commend itself to American grocers who, with paper none too plentiful, would probably welcome several billion nicely dried lotus leaves with which to eke out their supply of paper bags.

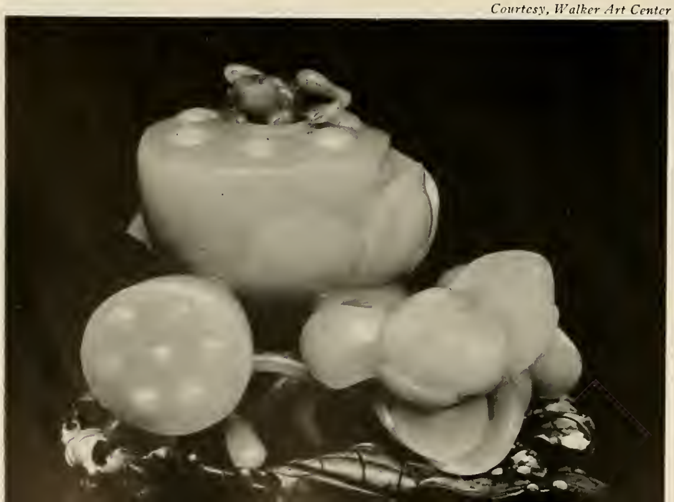
The chief utilitarian contribution of the lotus, however, is in the realm of food. The thick, succulent rhizomes are a common article of diet. For example, they are an ingredient in a dish in which they are sliced thinly and combined with beef. Chinese cooks also make lotus "boxes" – slices of lotus root put together sandwich-fashion with a filling of highly seasoned minced meat and then fried in deep fat.

Lotus seeds also have a medicinal value, and if candied, they have a pleasing nutty flavor. They are the base of *Lien-tzu-keng*, which is a sweet soup and a favorite among the Chinese. Upon consulting a Chinese cook book, we find that lotus seeds in varying numbers are necessary for certain viands – six for "Eight Precious Pudding," twelve for "Monk's Food," and twenty for stuffed chicken.

As might be expected, the lotus is featured in many works of art. Large families and numerous descendants have been the customary wish of the Chinese people. This idea is carried out in the popular painting, "Children by a Lotus Pool," which gives expression to the thought, "I hope you may have many, many children—as many as the lotus seeds." The lotus is also painted in company with either Mandarin ducks or egrets, – combinations which likewise have been used by the decorators of porcelains. On porcelains, too, the lotus figures in scrollwork supporting the Eight Buddhist Symbols.

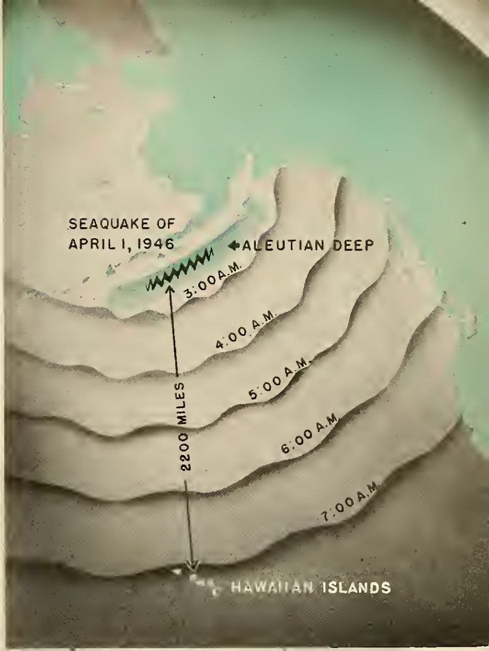
▼ A SMALL GREENISH-WHITE JADE container used by a Chinese scholar to hold the water for his ink stone. A frog of emerald green jade forms the stopper of this water coupe, which is in the form of a large lotus seed-pod. Eighteenth or nineteenth century

Courtesy, Walker Art Center



The Great TIDAL WAVE of 1946

Scientific knowledge of the ocean bottom is the key to seaquake waves, which every few years wreak their fury on man and his works



Drawing by Museum Illustrators Corps

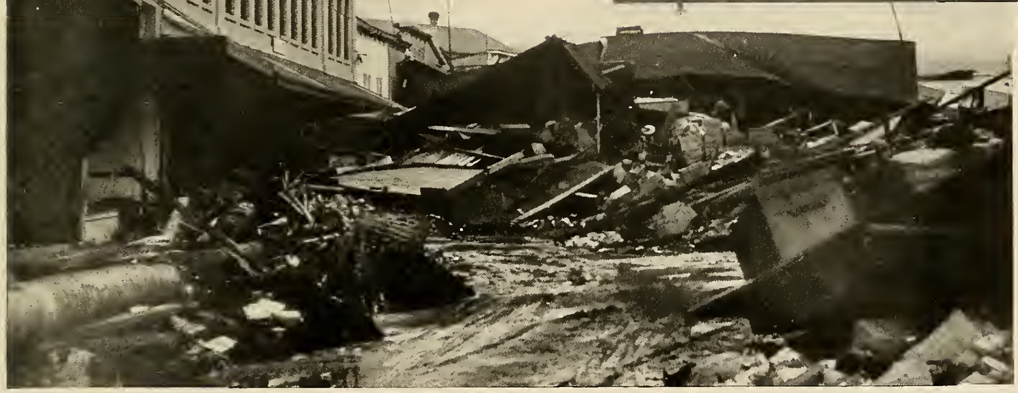


Photo by Sonny McNicol

▲ **Typical effect** of the tidal wave on the front street of Hilo, where all water-front houses were hurled across the avenue on the morning of April first

By T. A. Jaggar*

Research Associate in Geophysics, University of Hawaii

In terms of violent activity in the crust of the earth, the year 1946 is a significant one. It has witnessed a disastrous tidal wave, a gushing volcano at sea level in the Izu Islands south of Fujiyama, and a big earthquake and lava flow at Sakurajima Volcano 500 miles to the southwest.

Cataclysms of this sort were once considered utterly unpredictable and unrelated to any other known events. But the late Professor Omori connected the latter two localities because of their simultaneous activity in 1779 and 1914. The year 1946 verifies their relationship.

We have recently seen an earthquake in Alaska produce a tidal wave that spread destruction thousands of miles from its source. So, whether or not we can call this "one world" politically, we must certainly call it one world geologically. Perhaps we should even begin to speak of "one solar system," because volcanic cycles have been shown to correspond with periods of greatest sunspot activity through a century and a half of observation at the vol-

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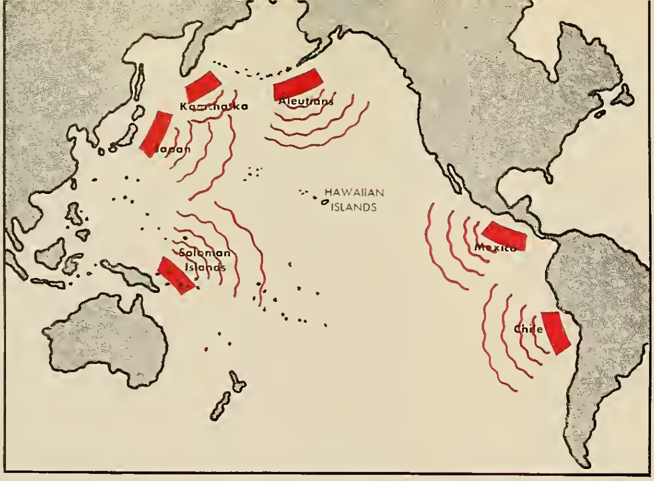
*Thomas Augustus Jaggar is a leading authority on volcanoes and related phases of geology, which he has studied for almost 50 years. His investigations have carried him to almost all of the volcanic regions of the earth, including several expeditions to Alaska, where the recent tidal wave originated. In 1911 he established the volcano experiment station in Hawaii, and he has devoted much time to the direction of research projects emanating from that locality. Today, he continues his studies as a research associate in geophysics at the University of Hawaii; and in addition to numerous technical contributions is the author of the recent book, *Volcanoes Declare War*. —Ed.



▲ SEAQUAKES capable of producing serious tidal waves can occur in six regions around the Pacific

canoes Kilauea, Mauna Loa, and Hualalai. In the 11-year cycles of Hawaii, 1946 is a culminating year after the dangerous 1935 eruption of Mauna Loa, and trouble is looked for.

The great tidal wave of 1946 originated at about two o'clock in the morning of April 1, 2200 miles north of Hawaii and under about 18,000 feet of water. A section of the sea floor slumped at the foot of a rock slope 150 miles south of Pavlof Volcano on the Alaska Peninsula. This event in what is known as the Aleutian Deep and its effect hours later at the other end of Nature's "telegraph line" is an old story. Five minutes after the sea bottom went down with a bump, the elastic jarrings in the crust of the earth activated Hawaiian seismographs. But the sea wave traveled much more slowly and required five hours to reach the islands.

The jar occurred when the sea floor deepened in an east-west direction, perhaps over a distance of some hundreds of miles. The water, rushing in to fill the hollow, piled itself up in a long wave. On neighboring Sanak Island and False Pass the shore was flooded only ten minutes after the shock. Both the Aleutians and Hawaii are old geology fields to the writer. The Aleutian Deep, as determined by the soundings of our Coast and Geodetic Survey, parallels the Aleutian Islands from west of Attu at the end of the chain and extends in shallower form even to Yakutat Bay in the Gulf of Alaska. On the Aleutian side, the wall of this trench is steep—as much as 30 degrees in places. Above this southward facing scarp, the Aleutian volcanoes rise 30,000 feet above the trough. Mt. McKinley, only 140 miles away, is 40,000 feet above it. On the Pacific side, the sea-bottom slope is much more gradual. For this reason, the tidal wave was projected more strongly southward.

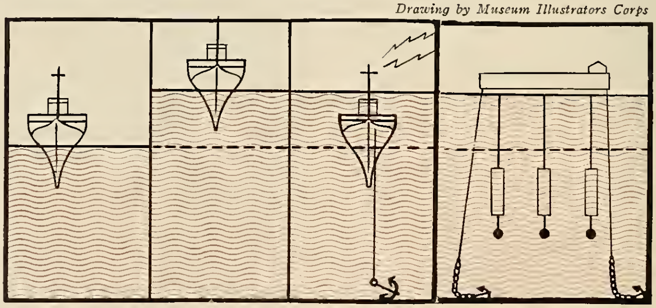
Apparently the ocean bottom is a slab which periodically slips down against the steep sides of the continent. The middle Aleutians belong geologically with the continent of North America, a sizable section of which is only slightly submerged beneath the waters of Bering Sea to the north.

When a long section of the Pacific bottom suddenly drops, we get a quake and flood wave. That is what occurred off the coast of the Alaska Peninsula on April 1, 1946. An immense volume of water—a quite incompressible mass of liquid hills and valleys, a hundred miles from crest to crest—struck out toward Australia. Tides created by the moon travel at 500 miles an hour across the Atlantic. The seaquake imparted a comparable speed to these waves. No ship was conscious of them under keel, though vessels over the epicentral line near Alaska felt the quake itself as a hard reflex thud. If a scientist could invent a ship's instrument to record the passing of the speeding water crest, he would save hundreds of lives, for there are scores of ships to send forward warnings. But they knew nothing. If they had been tied by slack cables to the bottom, they might have sent information by radio, tracing the progress of the wave.

The sad tale of what happened to the north shores of Hawaii has been told by the newspapers and photographs, and the scientific record will be compiled by the engineers, the hydrographers, and the seismologists. 'The foolish folk built

IN THE OPEN SEA THE TIDAL WAVE is perhaps 100 miles from crest to trough, and it lifts a ship so gradually that no one on board is aware of it. If the ship were tied to the bottom, there might just be time to radio a warning that the wave was on its way. But a large floating seadrome, stabilized by deep counterpoised floats and therefore unaffected by storm waves, could be anchored by slack cables and equipped with instruments to announce the passing of the tidal wave

Drawing by Museum Illustrators Corps



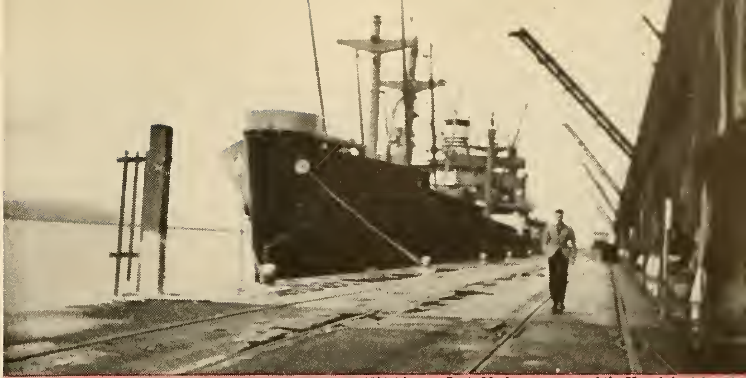
their houses upon the sand, and the floods came, and beat upon those houses, and they fell, and great was the fall of them.' In Tokyo in 1923 the ground moved sideways two feet, and 200,000 people were burned to ashes. In Hawaii, people trained to tidal waves, earthquakes, lava eruptions, explosive eruptions, and mud floods faced the ocean on the beach and were swept away by scores. Why? Because man knows the stars better than he knows his own earth. Let us look at the record and see what can be done about it.

There are six places around the rim of the Pacific where sea-bottom earthquakes capable of causing serious tidal waves can occur periodically. In the order of their importance, these are the deep trenches off the Aleutian Islands, Japan, Chile, Kamchatka, Mexico, and the Solomon Islands. Whether they are all places where the rock of the sea bottom tends to scrape downward against the continental edge is not known. Each one is backed by a line of active volcanoes. It is not known whether the troughs themselves pour up lava.

When a seaquake produces a tidal wave, the configuration of the ocean bottom governs its force to some extent. Seaquake waves from the Tonga Deep and the Philippines Deep are not known to reach Hawaii, perhaps because of the obstructing island ridges. And Hawaii itself is a gigantic ridge protecting the Carolines and the Marshalls. It must be remembered that we are not thinking of the islands themselves but of the ocean bottom from which they project, and that in relation to the underlying rock globe the ocean is a mere film of water.

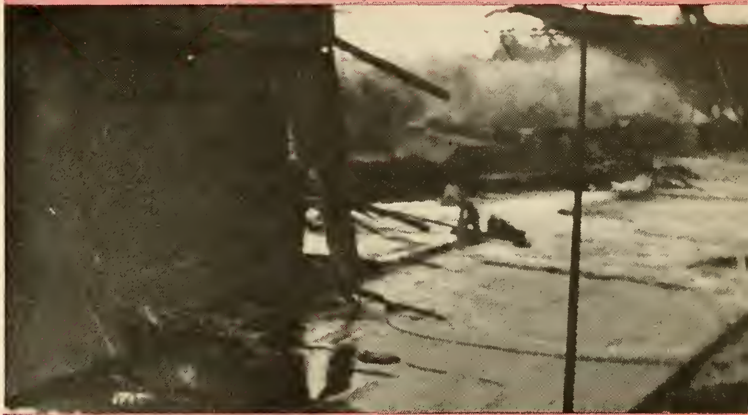
History

How is the present disaster an old story? Just 200 years ago, in 1746, the sea bottom off South America made an uprising of waters that carried a frigate several miles inland from a shelving anchorage, deluged the city of Callao, and even reached seven miles up the Rimac River to Lima. The wave doubtless reached Hawaii, for sub-

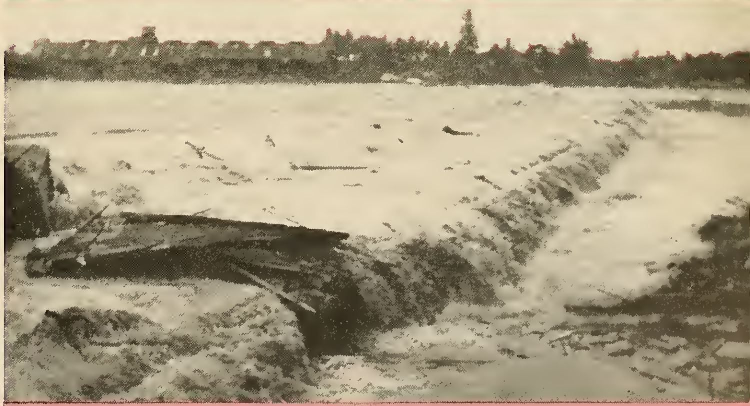


Photos by Cadet Midshipman C. A. Mudge, courtesy of the Honolulu Advertise

▲ The S.S. Brigham Victory, with 50 tons of dynamite aboard, was struck by the tidal wave at the Hilo Sugar Wharf. At 7:00 A.M., people on the dock yelled that the wave was coming. The water drained from the harbor, leaving the ship on bottom, then slowly came back



▲ The wave breaking over the land or breakwater side of the wharf, as photographed from the deck of the vessel. The man in the center was drowned. First Mate Edwin B. Eastman, in command of the ship, ordered the engines started and had her under way at 7:15



▲ The wharf as the water passed over it, wrecking 800 feet of shed and washing away all the boxcars and sugar. The waves continued for about two hours. By driving alternately full speed ahead and full astern, First Mate Eastman saved the vessel marine quakes off Peru produced Hilo's tremendous floodwaves in 1868 and 1877. One near Concepción, Chile, in 1837, deluged Hilo badly.

Recent lighter smashings of the Hawaiian shore line by water had their origins in separate points of the Aleutian trench. One of them, in 1938, originated south of the Alaska Peninsula like this year's. Another, in 1929, had its source 500 miles to the west, opposite Amukta Island.

The flood that a century ago traveled from Chile to Hilo and Maui was no different in quality from that of 1946. The wave came on November 7, 1837, during unusually low tide and calm weather, and the moon shed a gentle light upon the whole scene. Richard Armstrong the missionary, father of Samual Chapman Armstrong who founded Hampton Institute for Negroes in Virginia, tells us the sea retired 120 feet at Kahului on the north bay of Maui Island, and the inhabitants followed it down, eagerly catching the stranded fish and shouting with pleasure. Suddenly the sea rose perpendicularly before them like a precipice and, rushing upon the beach, buried the assembled multitude, overflowed the banks, and carried the entire village of 26 grass houses with all the Hawaiians and their effects some 800 feet inland. It threw most of the wrecked houses, broken canoes, fowls, beasts, men, women, and children into a small lake three miles in circumference, immediately inland from the village. The rush of the wave was so sudden and unexpected that no one foresaw it except experienced oldsters who knew that the outflow would be followed by an inflow and fled to high ground.

But it is not easy for mere water to baffle a native, for he lives in it half his life and knows the ocean's moods. Some swam singlehanded with the waves; others took the sick or aged and the children on their backs, and buoyed them up until the water ceased from the earth. One took his old mother to safety but, laying her down on the ground, found that she was dead. Another poor old woman got into the lake and was drowned.

One man found the water coming into his house and, seizing his child, ran far enough to escape the inundation entirely. Arriving at the summit of a small sand bank, he looked back and saw the whole village, inhabitants and all, moving toward him, some riding on the tops of their houses, some swimming, all screaming most frightfully. After this heaviest and highest wave, only two others swept over the bank; then the water abated from the earth. At Lahaina on the opposite side of the island, the waters rose eight feet.

This wave of 1837 came when water-front houses at Hilo were crowded with natives attending a meeting. At 6:30 P.M. a gigantic recession of the sea was followed by a wave roaring to the shore with noise like thunder, at the rate of seven knots. It rose 20 feet above high water mark and fell on the beach like a waterfall. People were swamped in the flood, and houses, canoes, and fish ponds were destroyed. The wave washed away the food and clothing of the inhabitants, along with quantities of animals, firewood, and timber at the market place on the strand.

The cries of distress were horrible. The people in the water, unable to swim amid the wrecked houses and pieces of timber, struggled for their lives, and those on shore wailed for their friends and relatives. Canoes were not available, but the whaler, "Cockburn," came to the rescue of many who, stunned and insensible, would otherwise have been carried out to sea. In two of the villages 66 houses were destroyed, and four men, two women, and five children lost their lives, while two women and a child were drowned in other villages.

This flood was probably just as severe as the one in April of this year, although the latter caused heavier losses, largely as a result of twentieth century congestion. A rough estimate for all Hawaii compiled a week after the recent disaster totaled 115 killed, 67 missing, and 500 houses destroyed. The same localities, Hilo and Kahului, suffered badly in both disasters, for they have shelving undersea platforms and confining embayments that render them vulnerable. The wave from Chile had traveled 3500 miles farther than the one from the Aleutian Deep, and it did not hit the islands broadside as did the latter. The 1946 flood struck directly on the face of the island ridge fronting the Aleutians.

The description of 1837 might be duplicated for the floods of 1868 and 1877, which were generated by earthquakes off Peru. The 1877 earthquake caused damage on the coast of South America in the evening of May 9, and the wave reached Hilo at four o'clock the following morning, in the dark before dawn. At 5:00 A.M. it invaded the shops on Front Street twelve feet three inches above ordinary tide. In Waiakea every house within 100 yards of the beach was swept away. Five lives were lost, 7 persons were injured, 163 were left destitute, 17 horses and mules were drowned. A vessel anchored in 24 feet of water found itself on the ground. At 7:00 A.M. one complete rise from low to high measured 14 feet vertically, and the pulsations continued at about half-hour intervals all day.

Instruments

By means of seismographs and an automatic tide gauge at Hilo, the Hawaiian Volcano Observatory has compared seaquakes and tidal waves since 1912. When a quake occurs off Alaska, Mexico, South America, the Solomon Islands, Japan, or Kamchatka, the seismograph gives a fairly accurate indication of direction and distance. Hours later a tidal wave may be expected. By correlating the results over a period of years, it has been possible to evolve a system whereby harbor masters can be notified when a wave may possibly be coming.

There is a popular misunderstanding about what a tidal wave can do. Hundreds of seaquake waves arrive at San Francisco, Los Angeles, Callao, Queensland, Japan, and Hawaii, but most are so small that the public never hears of them. They are recorded only by the tide gauges—floats under wharves writing continuously on chronograph drums. When a very exceptional one draws off the waters from the shelving bottom of a confined bay, the returning surge may cause disaster, but this is rare. The same kind of piling up of the waters may be produced by persistent hurricane winds, as in the beach floods at Swatow, Galveston, Mobile, and Florida.

The water in every bay, like that in any tub or dish, has its own normal rhythm of movement. Unfortunately it is apt to go into resonance with an advancing tidal wave to augment the heaping pendulum of the sea swells. In the Hilo and Honolulu basins, the normal periods are 20 minutes and 15 minutes, respectively. On March 6, 1929, the tide gauges were tracing their rhythmic ups and downs as usual. From 7 P.M. to 2 A.M. the water rose about two feet in a normal tide, and by 8 A.M. it had dropped the same amount. But at eight that evening, the pens in the recording instruments suddenly showed a downward movement of the water, followed by nine rhythmic swings in harmony with the normal short pulsations. These measured half a foot at Hilo, much less in Honolulu. They dwindled away in three hours and were evidence of an immense quake that had occurred five hours earlier near the Aleutians and had been recorded about five minutes after it had happened, by the seismographs at Hilo, Kilauea Crater, Kona, and Honolulu. Roughly speaking, the first tremor takes about as many minutes to reach the islands as the tidal wave takes hours.

This Aleutian earthquake had a different location from those of 1923 and 1946 and produced a lower wave. Probably lack of harmony with the basin periods also made the effect weaker. Hilo Harbor was notified, the sampan fleet was anchored off shore, waves broke a stern line on a steamer at the wharf, and the surges were noted from 7:45 P.M. to 10:00 P.M. at intervals of fifteen minutes.

Forecast

The seaquake wave of March 2, 1933, successfully demonstrated the methods of scientific forecasting that had been under study at the Hawaiian Volcano Observatory. Shortly after seven o'clock in the morning (Hawaiian Time) a distant seaquake occurred at the western edge of the Tuscarora Deep, 125 miles east of Matsushima, Japan. Near this place the ocean is more than 26,000 feet in depth. The elastic wave through the earth took ten minutes to reach Hawaii. It registered on the seismographs at Kilauea, Kona, and Hilo as a very big movement for several hours. The indicated distance was 3,950 miles; the direction, that of Japan. The hour and date were 2:31 A.M., March 3, 1933, Japan Time.

It was immediately apparent to A. E. Jones, seismologist at Kilauea, and to R. V. Woods, seismograph operator for the Hawaiian Volcano Research Association at Kona, on the west side of Hawaii, that a tidal wave might be on its way. About noon, the Radio News Broadcast announced the Japanese earthquake as a disaster, thus confirming the notion that the wave would come from that direction. Traveling at 450 miles per hour, such a wave would take eight and a half hours to reach Hawaii.

Mr. Jones notified the Hilo Harbor Master about 10 A.M. to look for a wave at about 3:30 that afternoon. The sampan fleet in the river was moved out to anchorages in the harbor. The waves came at 3:36 P.M.—within six minutes of the estimated time. The range of maximum motion in Hilo, on the east side of Hawaii, was from two to three feet.

On the western side of Hawaii, the side toward Japan, Captain Woods informed the Captain Cook Coffee Co. and American Factors at Kailua and at Napoopoo that the wave might come about nine hours after 7 A.M. The waves came at the time predicted with great force. The water first receded, then came a series of ten-minute swells that continued for hours. At Napoopoo the seventh wave was reported the greatest. There the water receded 8 feet below mean tide and rose 9½ feet above mean tide, a total vertical range of 17½ feet.

The sea bottom was left bare over wide tracts in the bays of Napoopoo, Kailua, Keauhou and even at Kaalualu at the southeastern end of Hawaii. Walls washed down, boats were unmoored and capsized, houses were flooded and moved, lumber was displaced, objects were washed out to sea, damage was done to interior furniture, automobile lorries were flooded so that the engines were damaged by sand, and goods were washed off wharves. At Napoopoo, the people remembered the events of 1896 and 1923 and removed cargo from the wharf in expectation of the wave.

At Honolulu the tide gauge made twenty fluctuations in four hours, each complete wave averaging twelve minutes. The waves were noted at Kauai, at west Oahu, and at Lahaina, and were somewhat damaging in and around Kawaihae on the northwest shore of Hawaii. The eastward-moving train of waves had struck Midway Island between 11:05 A.M. and 1:00 P.M. and had begun at Honolulu at 2:40 P.M. It reached the west side of the island of Hawaii at 3:20 P.M., and by 3:36 had struck Hilo.

This same event caused great disaster in Iwate Province, Japan, both from earthquake and tidal wave. The reported loss was 1,535 lives, 2000 wounded, 7,930 houses, 1,570 boats, and millions of dollars of property damage at the ports of Kamaishi, Miyako, Yamoto, and Omoto.

Statistics

The problem of lessening the loss from tidal waves is very different from the mere invention of a seismograph that will ring a bell or blow a siren. The tide gauges record several tidal waves a year. One of major interest appears about every two years. The nineteenth century average was one damaging wave in Hawaii every twelve years; now that records are more complete and congestion has increased, there is one about every five years. The following incomplete list shows the sequence of tidal waves and their dates in Hawaii, with only July omitted from the recorded months.

1819 May
1837 November 7
1841 May 17
1868 April 2
1868 August 13
1872 August 27
1877 May 9
1896 June 15
1906 January 31
1906 August
1918 September 7
1919 April
1921 December 16
1922 November 11
1923 February 3
1923 April 13
1924 May 30
1926 January 24
1927 December 28
1928 June 16
1929 March 6
1930 February
1931 October 3
1933 March 2
1938 November 10
1946 April 1

Waves from six directions on the globe and from distances of 2000 to 6000 miles may batter against Hawaiian shores. In three of these directions, perhaps four, there are intervening islands that might radio information. The rate of travel of the water waves varies from 284 to 481 statute miles *an hour.* Rock waves travel to the seismograph at from 350 to 440 miles *a minute.* The water in bays moves in a natural period that may be anywhere from 10 to 30 minutes. The motion is dependent upon depth and shape of the container. A can of water three feet long makes a slower wave than one six inches long. Finally, in 109 years we have had four major catastrophes by beach flooding in Hawaii; only the one in April of this year seriously damaged Honolulu.

Valid averages depend upon large numbers. One conflagration in 36 years in an area the size of the Hawaiian Islands would not interest a fire insurance underwriter. He works out a law of averages from thousands of small fires. Tidal wave damage does not reach large figures, but if coupled with damage from shore erosion, wind storms, cloudbursts, tidal action, thunderstorms, landslip, and earthquake, something might be worked out in the way of insurance. Practical methods of protection depend on international co-operation, and legislation to keep dwellings on higher ground. Quite apart from the avoidance of property loss, there is additional incentive in the preservation of shore lines for fishing, beauty, and recreation. Scientific preparedness can be developed under the sponsorship of organizations such as the Hawaiian Volcano Research Association which in conjunction with the University of Hawaii, can find out more about these forces, educate the public concerning them, and outline protective measures. Co-operation is needed with the Navy, cable companies, radio telegraph, various government agencies, universities and research laboratories, and with scientific establishments in Canada, Mexico, South America, New Zealand, and Australia, and with the nations of the western Pacific.

To notify unerringly a sensitive public, who are quite ready to accuse science of calling "Wolf!", a tidal wave bureau must know: (1) occurrence of a big quake, (2) its location under the sea, (3) whether it has made a wave, (4) whether the wave is headed this way, (5) when it will arrive and how big it is, (6) how to move the shore people. Japan has had reason to take such tidal waves seriously and has surveyed all its harbors to determine the natural period of swing and the normal tidal action. Japan's tidal wave records of the formerly mandated Marshalls and Carolines are of importance to us now.

This all requires new knowledge of the rock bottom underlying the mud of the ocean. Three-quarters of the earth is sea bottom concealed by mud. The Valley of the Jordan, 1,300 feet below sea level, has been spoken of as the lowest valley bottom on earth. Let us not forget the stupendous gorges off South America and Mindanao, 20,000 feet below sea level and more. These are the great unexplored valleys of the earth, and they are just as interesting geologically and mineralogically as other valleys, if we can only get at them.

There is a tendency to rest in the belief that submarine rocks can only be identified by the indirect methods of physics. Actually, they can be collected and examined like any other rocks if modern engineering science will only make the effort. Rock core samples can be obtained by driving tubes into the bottom of the ocean under explosive power. This is the most important scientific experiment unfulfilled in the whole realm of economic geology. A serious plan for exploration of the deep rock bottoms should be deliberately formulated. Seventy-two per cent of the earth's surface has never yielded a rock or ore specimen. That area is the ocean's bottom.

Ocean Bottom Laboratory

Hawaii is well-placed for this laboratory. Could we drain the ocean and look out upon the exposed bottom, we could see, 30 miles away, a vast territory 18,000 feet below us. Big volcanic domes would probably dot it here and there—one 8000 feet high is known to lie 200 miles east of Honolulu. We would be up on an enormous mountain range comparable to the Himalayas, and as on any very high mountains, we would have nosebleed and nausea, for the air would be down on the plain.

Soundings 100 miles apart give us our only maps of large areas of the ocean bottom, and volcanoes and hills may be far more abundant than indicated. The tremendous pressure beneath 2000 fathoms and more of water may have given them a flattened contour; lava from a crack would make a very different crater than on dry land, erupting sideways far and wide under a skin of hardened glass. A thermometer lowered to an area of submarine volcanic activity would show heat, and an anchored instrument would show motion. Is there any fresh water? There are thousands of hot spings on land; it is unlikely that the other three-quarters of the globe should be without them.

A laboratory for ocean-bottom research could be developed under six proposals:

1. Honolulu as a center of administration because of its oceanic range.
2. Tulsa or Los Angeles as a center of preparation, where engineers, physicists, and core-drill experts could help to develop the techniques to be used.

Continued on page 293

The story of the ROSES

By RICHARDSON WRIGHT

Editor-in-chief, HOUSE AND GARDEN

▲ ZEPHERINE DROUHIN

A search into the family tree of your favorite rose bush will send you traveling down romantic corridors of history and into many distant and fascinating lands

All photographs courtesy of Bobink & Atkins, except as otherwise credited

ONE spring, after a winter when the temperature had dropped to zero and hung below for a long spell, we found our favorite climbing rose—Silver Moon—dead to the ground, its canes a tangled, brittle jungle. All other climbers escaped.

This beauty had been sheltered by wall and fence, over which for many Junes it spread great discs of white and gold along far-reaching branches of bright green foliage.

To find the explanation, we began looking up its ancestry, and when you begin looking up the ancestors of a rose, there's no telling how far back it will carry you or into what distant lands, down what alluring aisles of history or into what chapters of romance.

We found one parent was Wichuraiana, a hardy white flowering, glossy-foliage, trailing rose that came to the United States in the 1880's via Brussels from Japan. On the other side was the tender Cherokee Rose, *R. laevigata*, also with dark, glistening foliage and a profusion of white flowers with yellow stamens, which hailed from warm regions of southern China. It was first described by an English botanist

▼ HARISON'S YELLOW, hybridized in 1830 by George R. Harison

▲ JEANNETTE, a Gallica hybrid, created by Descemet in the 1840's, and (below) Green Mantle, a scented Penzance or Eglantine brier of 1895

Color photograph by Frederick W. Cassebeer

▲ **FLORIBUNDA** is the modern name for large-flowered Polyanthas and is a new classification for a desirable bedding type of roses. They give recurrent bloom and need very little care

in 1705 and first cultivated in London in 1759; then it was brought to our southeastern states, where it went native. The French nurseryman, François André Michaux, who explored our eastern seaboard for new plants to send back home, found it there in 1803 and firmly believed it to be a native of this country. This was the ancestor from which Silver Moon inherited its winter weakness.

Just that one search, and we were well embarked on the history of the rose, which eventually sent us looking up Michaux and his famous father, who were figures in early American horticulture.

Tracing Ancestors

In winter, when rabid rosarians cannot work outdoors with their bushes, they while away leisure hours reading about roses. Among their milder diversions is tracing back the ancestry of some of their pet modern hybrids. Such research reveals the source of characteristics —color of leaves, shape of buds, fewness or abundance of thorns, mature height and manner of growth, absence or presence of fragrance. One rose enthusiast traced back the hybrid tea Yosemite, produced in 1934, through no fewer than 26 ancestors.

Let us try that with Radiance, a hybrid tea rose anyone can grow successfully—one that is found in most gardens. But why "hybrid tea"? Well, along about 1880 there appeared a new group of roses to which that name was given. They sprang from a cross between Hybrid Perpetuals and a Chinese tea-scented rose. (We'll try not to make this read like one of those begat chapters in the Old Testament.)

The Hybrid Perpetuals, a favorite type of rose between 1837 and 1890, have a five-way mixture of rose blood in them: the wild roses French Provence, Gallica, and the Damask rose; the hybrid Bourbon; and hybrid China, or *R. indica*. M. Laffay, a nurseryman near Paris, was first to produce them. They were originally called Damask Perpetuals, the perpetual referring to their recurrent bloom, which is the habit of the Damask tribe. Let's look at these in turn.

The Damask originally hailed from Syria (more about her later); the Provence Rose, native of the south of France, is listed botanically as *R. centifolia* and generally called the Cabbage Rose; *R. gallica* comes from Italy, Austria, and Switzerland as well as France, which gave it its botanical label.

In 1810 there came to England the original tea-scented Chinese rose (*R. indica odorata*), via India (hence the *indica*). It was a blush-colored rose and in England proved insignificant (it would not ripen seed), but in France it grew much better. Fourteen years later a yellow type arrived. From these the French produced many varieties.

Another Chinese rose came to England as early as 1790, but it was given little heed. It went under various confusing names—*R. indica*, *R. chinensis*, the China Monthly Rose, the Bengal Rose. On the equatorial French island of Bourbon this rose and *R. gallica* were grown in hedges. In 1810 a spontaneous crossing between them produced a rose which, on being sent to France, became the progenitor of all the Bourbon roses.

Early in the eighteenth century there was introduced to India from central China a monthly flowering scentless rose, *R. chinensis*, which came to be called the Bengal Rose. It brought the everblooming or monthly habit into rose development. A representative of this family, Old Blush Monthly, is still grown in our gardens. One of the first and final to flower, it was Thomas Moore's "last rose of summer."

So much for the various uncles, aunts, parents, and grandparents of the Hybrid Perpetual. Now about the crossing—who married whom? Roughly it goes this way:

Damask × Bengal = Hybrid China

Gallica × Bengal = Bourbon

Bourbon × Damask or Gallica = Hybrid Bourbon

Damask × Hybrid China or Hybrid Bourbon = Hybrid Perpetual

Now for the next steps:

Hybrid Perpetual × China Tea = Hybrid Tea.

Hybrid Perpetual × Austrian Brier (a yellow rose) furnished the progenitor of all our yellow Hybrid Teas. This last cross, made in our own time, has given us a tremendous range of color—and it has also weakened the plant, because the Austrian Brier is prone to black spot, one of the dread rose diseases.

But let us look again at the ancestors of that particularly popular Hybrid Tea, Radiance. Among the various tea-scented China roses appeared a variety to which was given the name Madame Bravy. The year was 1846. "Radiance" traces back to this ancestor on one hand, and on the other to a very fragrant, clear light crimson Hybrid Perpetual of 1863 called Madame Victor Verdier, hybridized by Eugene Verdier.

Each of these ancestors gave something to the modern Hybrid Tea rose.

Where do they get the perfume? Hybrid Teas of our catalogues are described as being "very fragrant." The scent came from the Damasks. Sometimes a "spicy scent" is indicated—that came from the tea rose. Where do they get the depth of color? From the Gallicas comes the deep reddish shade. The source of the yellow and copper we have already noted. Where do they get the form? The original tea rose was a weak, low plant. Into it was bred the strength of old and hardier roses, which gives us the sturdy Hybrid Tea bush of today.

This meeting up with ancestors of our popular Hybrid Teas brings us to the hub of several radiating roads. If we pursue Messrs. Laffay and Verdier, it will lead us into the exciting history of French rose hybridizing in the early years of the past century and eventually to Mal-

▼ Rosa Morica, a hybrid species, is almost thornless. Its pink flowers are followed by large fruit

▼ Rose des Peintres, often pictured by old Dutch painters, is a vigorous Cabbage or Centifolia rose

maison and the Empress Josephine walking in her rose garden with Napoleon, who delighted in her enjoyment of the roses. If we follow another trail, we will go wandering off into distant fields of China and the Near East, and, for that matter, almost the whole world, in search of wild species and the men who brought them back to our lands. If we take another, we will encounter a vast company of what today are called "old roses," which some rose fanciers are now collecting with persistent ardor. If we take still another, we will find ourselves in a melee of beetle-browed botanists puzzling over what rose is what and why.

We shall avoid the botanists who talk about "prickles" instead of thorns and hereafter go down other of those alluring rose roads.

Roses in the Wild

Species, as distinct from hybrids, are plants growing in their natural habitat in their original form. But even this is not an exact definition, because in some cases the original form is rarely found. What we do find are natural hybrids. Over the centuries one true species has been fertilized by another true species far away—by pollen carried on the wind or birds' wings or the proboscis of distant-flying bees and bugs.

It is estimated, although no two authorities agree, that there are over 100 known species or wild forms of the rose, and they come from as widely separated districts as our western prairies, the reaches behind the Yangtze gorges, the Near East, and England. Brought to civilization, these species are crossed with roses that we already have, to give new characteristics or greater strength.

Within the past few years a rose hybridizer of Ohio, for instance, introduced into his climbers the vigorous blood of *R. setigera,* the prairie rose, which is found from Ontario and Wisconsin to Texas and Florida. Its prickly branches attain six feet, bearing deep rose-colored, almost scentless flowers. From Alaska to Oregon and Utah grows the species *R. nutkana,* a stout five-foot bush with solitary pink flowers. Coming from Alaska it is endowed with winter hardiness. This has been used to strengthen a recent Hybrid Tea with rose-pink flowers suffused with yellow—Ernie Pyle. From the austere borderlands of China and Tibet, Ernest H. ("Chinese") Wilson brought home a vigorous, hardy rose in 1903, which he named Moyesi, after a missionary who had given him hospitality. Its flowers are a rich, lustrous red and its hip brilliant scarlet. This is one of the parents of "Dr. Huey," a spectacular climber bearing clusters of large, ruffled, maroon-red flowers.

Four Great Rose Families

Many of the roses we grow in our gardens trace back to four old roses or combinations of them. These are *R. centifolia* (the hundred-petaled rose), *R. damascena* (the Damask Rose), *R. gallica,* and *R. alba.*

The original species *R. centifolia* is a native of the Caucasus, and as it was also found in the old French province of Provence, it came to be called the Provence Rose. It had been the popular rose of ancient Rome and is doubtless the hundred-petaled rose that Pliny mentioned. Today we call it the Cabbage Rose. English gardens have been growing it since 1596. In the early years of the nineteenth century, before Hybrid Perpetuals became fashionable, many hybrid forms of *R. centifolia* appeared, the catalogues listing no less than 70 varieties; today they are few indeed. This old rose flowers in a globular shape, and its descendants show vestiges of the same shape, together with varying shades of pink. They are also usually heavy in fragrance.

The arrival of the Damask—or Damascus—Rose on the Continent and in England is generally attributed to the crusaders returning from

▼ Delicata, a popular old Rugosa, bears showy double pale purple-pink flowers in recurrent bloom

▼ Old Pink Moss, the father of all mosses, came to England from Holland in 1596

▲ ROSA MUNDI, one of the Gallica hybrids, produced by Vibert in 1875, is the most popular of the striped roses. Not to be confused with York and Lancaster, which is splotched

its native Syria. It is a stronger and sprawlier grower than the hundred-petaled rose; its leaves are pale green and slightly downy, and its fragrance is outstanding. Some of the blood of this rose went into the make-up of the Hybrid Perpetuals—they inherited its habit of second flowering. The old York and Lancaster Rose—white petals splotched pink—is one of its descendants. Still another is "Madame Hardy," one of the most beautiful of white roses, which M. Hardy, keeper of the Luxembourg Gardens, produced in 1832.

The Damask is the most highly perfumed of the old roses, and from it comes most of the perfume of modern roses. The variety Kazanlik is used extensively by the Bulgars for extracting attar.

Although it grows abundantly in Italy, Austria, and Switzerland, *R. gallica* is called the French Rose, because it is a native of France. Sometimes it is referred to as Provins Rose, since a French town of that name was the center of an ancient industry which made a medicinal, heavily scented conserve of roses. In the fields about the town this rose was grown in great quantities. As *R. gallica* bears seeds freely, it produced hundreds of varieties, among them the red and white striped Rosa Mundi. One of the marks of its beauty are the golden stamens of the single types.

The fourth of these rose parents, *R. alba,* is widely distributed in Europe and as far east as China. It is a handsome spreading bush, growing four to seven feet high. Its leaves are pale, dull blue-green and, as the name implies, the flowers are single, pure white, with bright yellow stamens, borne abundently.

By no means do these four exhaust our rose parents. There is *R. moschata* or musk rose, a native of the Pyrenees and later found in Northern Africa, Persia, and Madeira, which derives its name from its musk fragrance, especially noticeable on damp days. There is *R. multiflora,* which came from the Far East to England about 1780 but was not used for hybridizing until the 90's. Much later another arrived in France. It is one of the parents of our many-flowered ramblers. There is *R. rugosa,* the hedge rose of Japan, introduced into England in 1784 and through hybrids in this country somewhat later. Its characteristics are rough leaves and recurrent flowering.

There is *R. lutea,* the Austrian brier, native of western Asia, Italy, and Austria. Early brought to England—1586 is the first date—, its vigorous bushy growth and yellow flower gave it distinction. It was one of the parents of Harison's Yellow, a rose now cultivated in American gardens for over a century, having first been hybridized by George Harison in 1830 in his New York garden, where Eighth Avenue and 34th Street are today. In addition, as we have seen, it gave us our yellow Hybrid Teas, hybridized by the French rosarian, Pernet.

The moss rose, favorite of old-fashioned gardens, is a form of the cabbage rose, being known to botanists as *R. centifolia muscosa.* It differs from cabbage roses only in that it has mossy buds and more abundant bristles on the stem.

Of the seven roses that Britain has given the world, the two best known and most prominent in rose history are the Scotch rose, *R. spinosissima,* and the dog rose, *R. canina.* The Scotch are the most spiny of all roses, with bushes growing from one to four feet high in a rounded shape and bearing an abundance of small flowers, generally white. The dog rose, found blooming in June along the byways of Great Britain and Ireland, will shoot up to nine feet, with flowers of deep pink and stout prickles shaped like a dog's teeth.

In 1597, when John Gerard wrote his *Herball of Plants,* he recorded twelve roses being grown in English gardens, eight of them wildlings native to England, Scotland, and Ireland. In later enlarged editions up to 1639, we find York and Lancaster, still offered by today's nurserymen, and Rosa Mundi, the striped rose which dates from 1581. But that was before the age of hybridization. As explorers brought back wild roses, the numbers increased in English gardens. The same was true of France and Holland, and, of course, in our gardens here. In early Colonial gardens the roses were mainly June bloomers—*gallicas,* including Rosa Mundi, *centifolias,* and a few damasks and musk roses, together with native kinds brought in from the wild. Then, as new hybrids appeared or newly found species and wild hybrids were brought to England and the Continent, some of them drifted over here in time.

Hunters of Roses

The first batches of new plants sent back to England and the Continent from the prolific store of the Far East were found and dispatched by plant-minded men of the various national East India Companies.

One of the earliest introductions was the Macartney rose, *R. bracteata,* brought to England in 1765 as the result of an embassy led by Lord Macartney to the Emperor of China. Some of the blood of this tender rose is found in a lovely modern white climber, Mermaid, to which gardeners up north must give special winter protection. Nineteen years later (1784) there was introduced into England that rough *R. rugosa,* but for many years no one realized its possibilities and not until a hundred years later did its hybrids begin appearing.

Next was William Kerr, who in 1807 brought from China a double white rose which was named Banksia in honor of the wife of Sir Joseph Banks. Twenty years later a Dr. Abel found a double yellow variety growing on the walls of Nankin.

In 1812 the Royal Horticultural Society sent its first plant explorer to China, John Potts, and in 1843 the most picturesque of them all, Robert Fortune, who eluded the ban preventing foreigners from penetrating inland by traveling disguised as a Chinese merchant. In 1846 he sent back a new buff tea-scented rose and in 1850 one with large double white flowers, a natural cross between Banksia and Cherokee, which bears his name.

The true rambler rose, *R. multiflora,* with single white flowers in large panicles, was sent from Japan to France in 1862 by an engineer, M. Coignet. Seeds produced the polyantha rose, a low-growing type. Crimson Rambler was the first popular climber of this parentage.

Long before this, Dutch East India men, late in the eighteenth century, had introduced the Bengal rose into Holland.

Often a rose that was known of indirectly would elude "discovery." Thus a Chinese drawing of the yellow shrub rose Xanthina permitted it to be pictured and named in 1820, but not until 1908 was it introduced by F. W. Meyer of the United States Department of Agriculture.

Missionaries with a botanical bent proved most fruitful collectors of new plants and seeds. Today, for example, a yellow shrub rose called *R. hugonis* flourishes in many of our gardens. Its discoverer was a Welsh priest, the Rev. Hugh Scallan, who collected the seeds in his Chinese missionary travels and sent them to the British Museum. These were planted and later identified by botanists. Among one of his shipments were the hips of a rose which, when it grew, proved to be something new. Today it bears his first name *R. hugonis.*

Some of our American wild roses were introduced into the British Isles and France, *Rosa Virginiana* being especially liked. But one of the most influential strains came not from the wilds but from a cultivated garden in Charleston. It was sent by Philippe Noisette to his native France.

Philippe Noisette, after being in the United States four years, during which he improved his knowledge under André Michaux, reached Charleston in 1794 and set up as a nurseryman there. John Champney, a local gardner, had raised a rose from the seed of a musk crossed with a blush China. From the seed of this hybrid, Philippe Noisette in turn produced a rose that was distributed as Blush Noisette by his brother Louis in Paris. It was first sent to France in 1816.

The Blush Noisette that Philippe sent from Charleston was parent to a host of roses that figure in many catalogues. Marechal Niel is particularly well known.

Josephine at Malmaison

One of the great gardens of its time was that made at Malmaison under the direction of the Empress Josephine. She commanded the best horticulturists and botanists in France, who established for her a great botanical collection and a rose garden destined to play a leading role in the history of the rose.

In the manner of crowned heads with unlimited purses, she ordered to be assembled at Malmaison examples of all roses being grown in France, England, and Holland. It is estimated that they totaled about 250 species and varieties. These were acquired from various sources.

Many came from the environs of Paris, some from the Vine Nursery of Lee & Kennedy near London (which early grew roses in quantity), and from the Dutch, mainly from Van Eedam at Haarlem, who had been specializing on *R. gallica* hybrids. No list of what actually was planted at Malmaison is in existence. The only way of determining what grew there is to note from contemporary catalogues and garden plantings the roses known to be available between 1805 and 1810, the years when the roserie was being assembled and planted.

While the Dutch were probably the first to grow new varieties of roses from seed, André DuPont was the first in France. Before that time reproduction was by layering, cuttings, and natural hybrids. While grafting was well known, it was little applied to roses. Nor was the rose at this time a special favorite. The few amateurs and professionals devoted to it lamented the public neglect of the Queen of Flowers. The attention of gardeners was overwhelmingly directed to anemones, hyacinths, tulips, and carnations.

DuPont began as an amateur and was collecting roses besides hybridizing them. His nursery ran along what is now the Rue d'Enfer. Here he made his rose seed beds. In 1813 his collection was bought by the Government and became the bed of roses at the Luxembourg, of which he was director.

Even before DuPont was raising seedlings, Vilmorin père—Philippe Victoire L. de Vilmorin—had displayed a lively interest in roses and assembled a promising collection. The seed house of Vilmorin, which was founded a century before, still exists today.

M. Le Compte Leleiur de la Ville-sur-Arc, superintendent of Malmaison, was a rose-fancier of long standing. In 1811 he added to the literature on roses by writing a practical book, De la Culture du Rosier.

Jacques Philippe Martin Cels, botanist, was born at Versailles in 1740 and died at Montrouge in 1806. It was near Montrouge that he conducted his famous nursery—by far the most complete on the Continent—containing a prodigious number of exotic plants. In 1800 the botanist Ventenat made a catalogue of this garden, for which Redouté did the drawings. Cels re-introduced *R. damascena* into France, and Thory, who wrote the text for Redouté's flower prints, named it *R. celsiana* in his honor.

A fifth rose personage who had a hand in supplying plants to Josephine was Descemet. He was mayor of St. Denis, where he conducted a remarkably well managed nursery for many years. His collection of roses was extensive and varied. He, too, went deeply into hybridizing. In 1815 he was growing 10,000 rose seedlings, a large number for that time. When the Allied Armies threatened Paris and his nursery, J. Pierre Vibert hastened to the place, bought and dug up those precious plants, and carried them to the safety of his own nursery at Chenevieress-sur-Marne. It was early August, the worst possible month to transplant roses, yet Vibert managed to make the majority of them survive.

Rosarians in those days were so few and the chance to serve the empress was such a distinguished honor, that they must have gladly shared their plants and their advice. One was Guerrapain, whose roserie flourished at Troyes in what is now Belgium, and who further established his reputation by publishing in 1811 an Almanac des Roses in which he gave detailed descriptions of 170 roses and, what was unusual at the time, their common names used by professional gardeners and amateurs. Another was Parmentier, mayor of Enghein near Brussels. Two more were Godefroy and Ledru. Godefroy had been gardner to Barras, an intimate of Josephine before she married Napoleon. His four-acre nursery at Ville d'Avray near Sèvres had been started a little after DuPont's and Vilmorin's and on the same lines as Descemet's; his catalogues soon were listing more than 500 species and varieties. By 1846, according to the Annals of the Société Royale d'Horticulture de Paris, he was the dean of rose growers. The other was an amateur, Ledru, mayor of Fontenay-aux-Roses, whose property and collection at Ledru-Rollin commanded attention. Still another source of rose information and plants for Josephine's roserie must have been the château of Surcelle, where M. Menage had begun a rose collection in 1790, which he and his son maintained until 1810.

These gardens were rich in species. They had most of the types from which the ancestors of our modern roses have descended. From them and from the English and Haarlem nurseries came the greater part of the 250 kinds of roses at Malmaison. In time, Josephine's insatiable desire to own all the roses available gave rise to an enthusiasm for roses that spread over France, making it the flower *par excellence* of that country and France the great rose-producing nation.

Influence of the Rose Garden

Botanists and men and women of affairs who followed the popular eighteenth century cult of natural science would flock to see any exotic collection, so the curious public and nurserymen trooped into Malmaison to see the roses. Many of these nurserymen who showed a lively interest in Josephine's hobby were to receive assistance in their adoption of it from her privy purse. Because she set the style and they quickly accepted it, the rose immediately became fashionable. Nurserymen and amateurs all over France began growing and hybridizing roses.

One of the first was J. P. Vibert, mentioned earlier, who acquired his

Continued on page 293

WASHINGTON *Rat Race*

Photo from Ewing Galloway

When typhus was discovered in our national capital, health authorities could waste no time. Every city should recognize the conditions that favor this ancient scourge and know the latest methods for combating it

By Edwin D. Neff

NOT long ago in the city of Washington, D. C., a young girl contracted typhus fever. It was well past the typhus season, and the city's Health Department was curious. Typhus is carried by the fleas and mites on rats, so the Health Department knew where to begin its investigation. The girl recovered, but it shortly appeared that her recovery was the sole bright spot in a steadily blackening picture.

Traps set in her neighborhood, near the Union Station, quickly yielded live rats for blood sampling. And the blood samples, sent to the National Institute of Health, research arm of the U. S. Public Health Service, showed that a frightening percentage of the rats were typhus infected.

Then an entomologist, assigned by U. S. P. H. S. to the city's Health Department, discovered that the rats carried oriental fleas and tropical rat mites, both carriers of the typhus germ. Live rats, trapped in the same neighborhood continued to show positive blood.

At this point the director of the Health Department's Bureau of Sanitation, Lt. Col. William H. Cary, Jr., announced to a startled public that, in the year 1946, persons living in a section of our national capital were not free from the threat of typhus. Not long ago, another case occurred, also caused by rat fleas.

Two hundred years and more ago, epidemic typhus was one of the great scourges of Europe,—a disease whose history, as noted by the celebrated clinician Sir William Osler, "is written in the dark pages that tell of the grievous visitations of mankind by war, famine and misery." In its epidemic form it is transmitted mostly by lice, from one person to another, apparently gaining in virulence in the process. The person stricken suddenly exhibits a rash and a continuous high fever. The disease is especially dangerous to persons beyond middle age; more than half of those afflicted may die.

Flea bite typhus, with which we are dealing here, fortunately runs a much milder course. It is caused by a similar organism but is transmitted from a rat by the bite of a flea, rather than from person to person by lice.

Typhus is associated with unpretty conditions—rats, trash, and garbage, and antiquated buildings. A community that did not nip it in the bud would be ashamed as well as frightened. This is the story of what the capital city did and is still doing to rid itself of the typhus-bearing rats. It is also the story of what any city can do.

When the situation was realized, Washington began to awaken. But the nightmare continued. There were at least as many rats in Washington as people. Probably more, but nobody knew how many. Letters began to arrive in newspaper city rooms and in the municipal building. All reported rat-ridden alleys and buildings and trash dumps. An ancient pamphlet, gotten out by the Sanitation Bureau, guessed that rats were costing the city $15,000,000 annually. But that had been several years ago. Again nobody knew what the present picture really was.

The city learned that its Health Department had scarcely a dozen persons available for rat-control, and most of these untrained. There had been requests for more workers, more equipment. The requests had died somewhere in an agony of foolish economy. Health Officer George Ruhland then took the one remaining step. He called in the U. S. Public Health Service for complete technical advice.

Dr. John J. Essex, one of the Federal health service's most expert rat-control and sanitation engineers, was ordered to Washington from Atlanta, Ga., and then began a war between twentieth century science and rats.

The technique of ridding a community of rats—and the threat of typhus—is not that of magical Pied Pipers who drive out rats overnight or within a few days or weeks. It is not a story of a problem solved and then forgotten.

Rats are still man's worst enemies in the animal world. They are tough and smart, and fight like mad to survive. They carry many kinds of disease besides typhus and destroy food, clothing, and even leather goods. The U. S. Fish and Wildlife Service has pictures of golf bags, their leather bottoms eaten to shreds by hungry rats. Civilization, fatal to most wild animals, is actually a boon to rats. The cities provide warm places to nest in winter, and usually ample food the year 'round. It is easy food to get. It is found among uncovered garbage pails, unprotected stores on pantry shelves, and on trash piles and city dumps.

And rats are great travelers. They can bum a ride on almost any vehicle used by man. If they are driven from one house, they crawl next door. Driven from a neighborhood, they appear in near-by settlements. Chased from a city, they show up in the next town where food is plentiful. They travel by truck, train, and ship.

One of the first things Washington did under Dr. Essex's advice was to trap all points where commercial transportation entered the city. The fact that the first human typhus case and the infected rats were found in the Union Station area suggested that the disease had been carried into Washington by foreign rats. So freight terminals docks, railroad stations in suburban areas, bus and truck terminals were trapped. Fortunately, none of the rats were typhus infected. The infection seemed limited to the Union Station area.

The Health Department now began an intensive investigation of this area. Some 300 steel muskrat traps, provided by U. S. P. H. S., were set in a zone comprising 15 city blocks in which the disease had occurred. At this point in the program the object was not to kill rats but to trap live ones for study. Additional blood samples were sent to the National Institute of Health for the complement-fixation test for typhus, and the rat fleas were carefully identified. The blood samples continued positive, and more oriental fleas and tropical rat mites were found on the rats. On the fifth day after the traps were first set out, all traps and rats were

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Coins without milled edges Led to a Typhus Epidemic

Condensed from Howard W. Haggard's *The Lame, The Halt, and The Blind* (Harper & Bros., 1932)

Photo of coin, courtesy The Chase National Bank, New York

In London in April, 1750, a case came before the Old Bailey Court that attracted many famous judges and lawyers. As the doors opened to admit the prisoner, a Mr. Clark from Newgate prison, those near him tried to crowd back, because the foul odor of the crowded jail still clung to him. A week after the trial, the Lord Mayor, 3 judges, 8 jurors, and 40 clerks and spectators had sickened and died of a fever. England was in the throes of a typhus epidemic.

This shocking episode developed as a consequence of the failure of the English government to put milled edges on its coins. Before the latter part of the seventeenth century, English coins were made by hand. A flat piece of metal was snipped roughly into shape with shears and beaten into a coin with a die and a hammer. Since there were no milled edges to protect the coins against mutilation, it became a widespread habit to clip metal off and sell it. In spite of the severest penalties, the coin became smaller and had to be replaced at intervals.

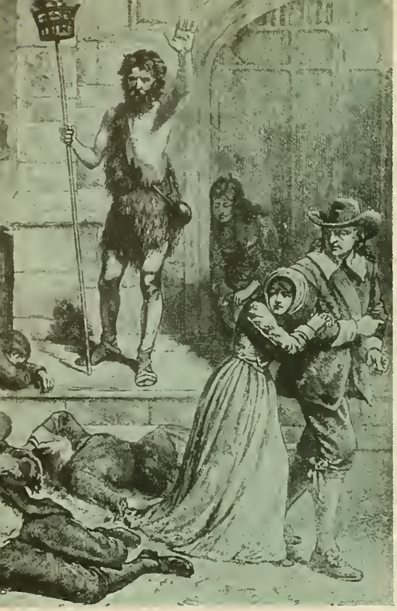
Forced to act, the government recalled all the old coins and undertook to produce new ones with milled edges. They were manufactured by a minting machine operated by a horse that walked round and round like that of an ancient grist mill. But the old coins yielded far less metal than they had originally contained, and it was necessary to increase the supply. A tax had to be levied.

The tax decided upon was one on windows—a classic example of legislation enforced on innocent people to make up for the cupidity of others.

As so often before and since, two wrongs did not make a right. A fixed sum was assessed for each window and each skylight, and there followed a period in which windows were bricked in and skylights were roofed over. Great tenements stood with scarcely a window opening. The English poor were crowded into rooms where sunlight never came. In jails, the jailer was forced to pay the tax, because in those days running a jail was a concession—and a profitable one.

Lack of fresh air did not cause the typhus epidemic, because the disease is transmitted by lice; but the dirty, damp, dark rooms were ideal for its spread.

The 1750 session of Old Bailey Court was one instance where typhus broke from its squalid hotbed to strike some of those to whom the window tax had meant little or nothing.

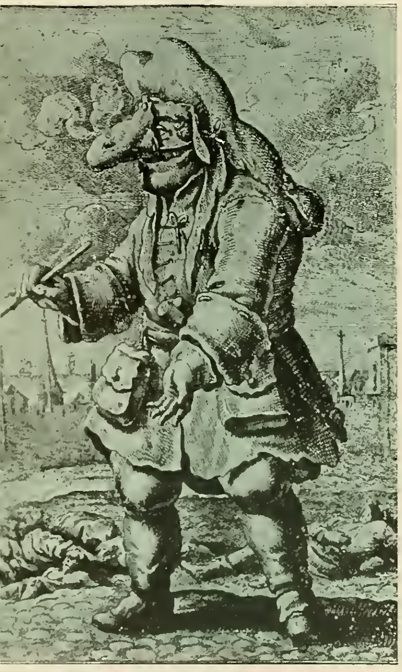


The Bettmann Archive

⮝ A MANIAC pronounces the doom of London during an eighteenth-century typhus plague

⮟ A GERMAN plague-doctor of the eighteenth century. He wears a nose-guard to protect him from some of the nauseating odors of his patients, and he feels their pulse with a stick to avoid personal contact with them

From an old German handbill



picked up, after which the entire area was dusted with the deadly insect killer, DDT. The next day the area was again trapped for live rats to determine the effect of the DDT on the fleas and other parasites. Prior to the DDT dusting, most of the rats had typhus-carrying parasites, and as noted, a number of the rats themselves were infected. There was some indication that the DDT had reduced the rat parasites, but the test could not be called conclusive. The next step was to begin wholesale rat-killing with traps and poisoned bait.

So far the program had been a public health study, its purpose to discover the focal point of the typhus infection among the rat population, then eliminate it.

Health Department teams, under guidance of Dr. Essex, now were ready to begin killing rats. The poison bait consisted of small torpedoes encased in colored paper. There were two types, one with cereal, the other with a fish base, but both using red squill as the poison. Some 6500 torpedoes were set, and a few days later only 1100 were left. Since this was a residential area, with many children and pets, the deadly 1080 could not be used. Red squill, deadly to rats, is harmless to people and most pets.

But 1080 was used in two buildings, a warehouse and an old, partially abandoned office building. Altogether, 455 small paper cups containing approximately ½ ounce of the 1080 in solution were placed strategically about the buildings.

The 1080 is actually palatable to rats. When one rat has drunk the solution, another, ignoring his comrade's fate, will eat the paper cup. If another rat eats a 1080-poisoned rat, he too will die. Unfortunately, any dog or cat dining off such rats will suffer the same fate, so the poison must be used with care. This was the first time 1080 had been used in Washington, and the Health Department reported that it cleaned rats out of both buildings.

While the trapping and poisoning were going on, sanitary inspectors visited premises considered rat-menaces and ordered the owners to clean up. Court orders were issued when the owners failed, but 85 per cent of those notified co-operated.

Meanwhile, under Dr. Essex's suggestion, a public education program began. A committee on sanitation of the Board of Trade met to hear Col. Cary and Dr. Essex outline the city's rat-control program. Dr. Essex suggested that school children were among the best crusaders against rat menaces, recalling that when a number of southern cities had taught proper methods of covering garbage and trash as well as the rat-proofing of homes and buildings, parents were badgered until they cleaned up.

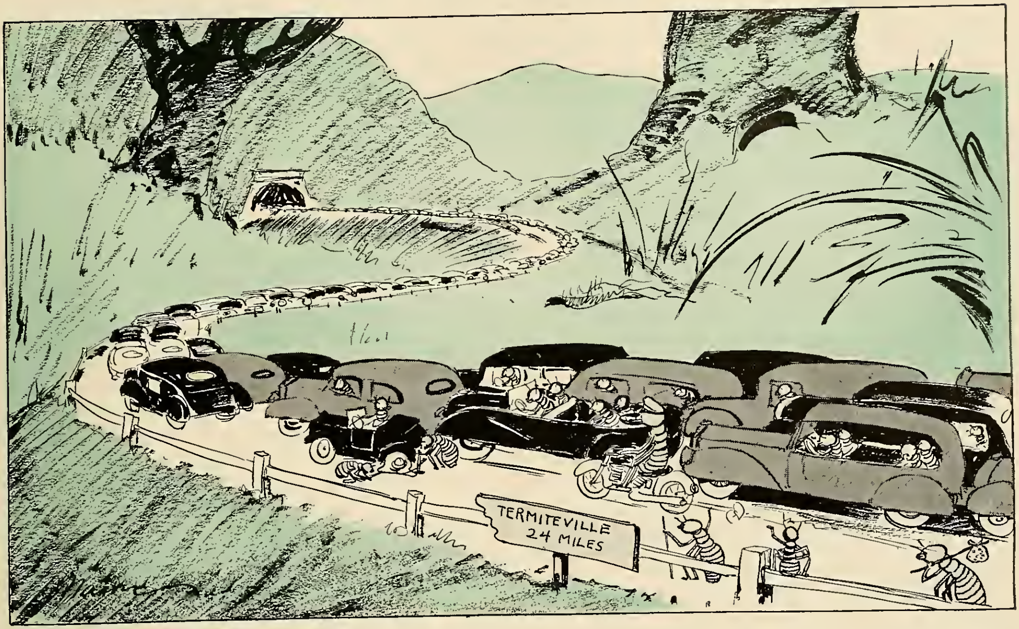
Dr. Essex told the committee the heart of the rat problem was to persuade a community to eliminate rats' food and shelter. Remove food and shelter, or make them inaccessible to rats, and they quickly travel elsewhere. That, he explained, is why rat-control is really a national problem, with all towns, cities, and states co-operating. A community cannot conveniently kill all its rats. But it can remove the reason rats are there.

When the Union Station area had been cleaned up, the Health Department consulted the U. S. Fish and Wildlife Service for permanent assistance in rat-control, and a rat-control expert has been assigned to Washington. The Fish and Wildlife Service is concerned only with the economic aspects of rat-control, while the Public Health Service is concerned with the health menace created by rats.

Washington now has a complete, scientific rat-control program, which will cost some $75,000 annually. It provides additional expert sanitation engineers and inspectors. But so far, it is only on paper. The fate of the program will depend on Congressional appropriation, which, in turn, depends upon community education.

There are still rats in Washington, but at least the city now knows what to do about them. It is hoped Congress will legislate them out of town.

TERMITE HIGHWAY



By John Eric Hill

Drawing by

G. Frederick Mason

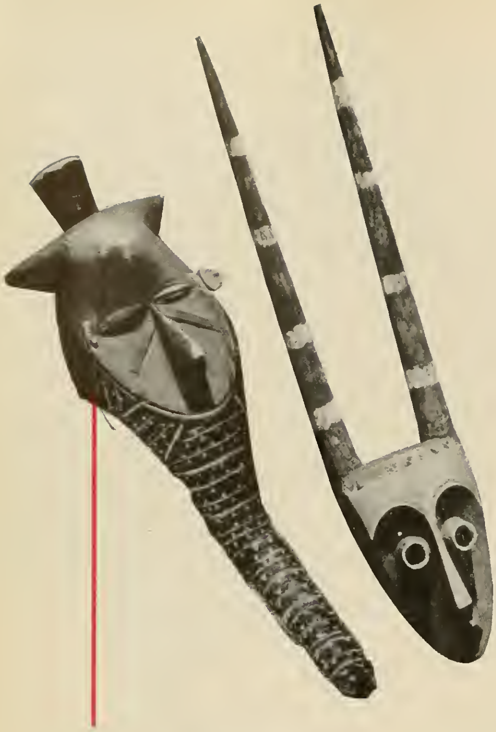
BUMPER to bumper, the automobiles move slowly along the highways that lead to and from our large cities. As peacetime habits return and tires cease to be scarce, these traffic jams will be common on holidays and week ends. To speed up travel numerous express highways are planned, spanning valleys and cutting or tunneling through hills and mountains.

Suggestive of such highways are the structures built by certain termites or "white ants" in far-off Malaya. Their roadways are broad and almost level or gently graded; they bridge depressions and are supported by buttresses. The pavement is clay mixed with gluelike saliva and excrement, and it is almost as hard as cement. Along the sides may be curbing or low wall. Workers, six or eight abreast, pass to and from the nest over these termite highways in steady streams, looking much like cars on a crowded road and with almost as much order. Sturdy, big-jawed soldier termites stand guard along the highway, their weapons directed toward possible enemies, such as ants, that might raid the crowd of workers. Both workers and soldiers are sightless and depend on their sense of smell and hearing.

The queen and king of this community, mother and father of their colony, do not leave the nest. The queen is much larger than any of her subjects; her abdomen is swollen with a multitude of eggs, giving her the appearance of a large white grub and dwarfing her head and limbs. She can hardly move but does not need to, for her business in life is to lay eggs at the rate of several hundred each hour. The king is much smaller than his consort but larger than the workers. His function, too, is only reproductive.

These Malayan termites, unlike most species, go out into the open to forage for their food. Termites usually live in darkness and shelter; many kinds spend their lives in the ground, coming up under fallen trees or other wood. They burrow through the wood, eating away the inner parts but leaving a whole outer shell. The termites that do so much damage in parts of the United States often build covered roadways across open spaces. Should they find their way into a basement they may build such a tunnel up the cement wall to reach the wooden beams. The tunnel may be made of "carton," wood-pulp mixed with saliva, or of sand or clay similarly cemented, depending on the kind of termite. Were a section of the roof to be removed, streams of termites traveling to and fro would be seen.

Tunnels are built not only because termites dislike light and have many enemies. Their chitinous armor is thin and does not protect them from drying up when exposed to free air, except when the humidity is near saturation. In the tunnels the air is as moist as in the nest; they are "all-weather" highways in which the usual conditions are reversed. Foraging termites are often covered with heavier chitin than their relatives and are thus better able to resist evaporation, and they are restricted to the tropics where the air is generally moist.



MASKS

AND MEN

Introducing a remarkable display of primitive and exotic art now open to the public at the American Museum of Natural History, in a new hall of modern design constructed especially for temporary exhibits. The exhibit will be open until September 1

By Margaret Mead

Associate Curator of Ethnology, American Museum of Natural History

All photos by A.M.N.H.

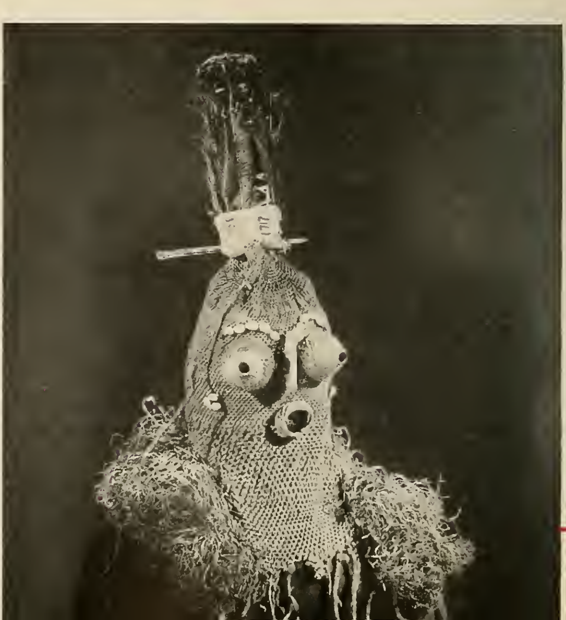
▲ (*Left*) A Bapende elephant mask; (*right*) a mask from the same tribe combining human and animal features

The mask is a man-made device that illustrates the basic psychological unity of the human mind.

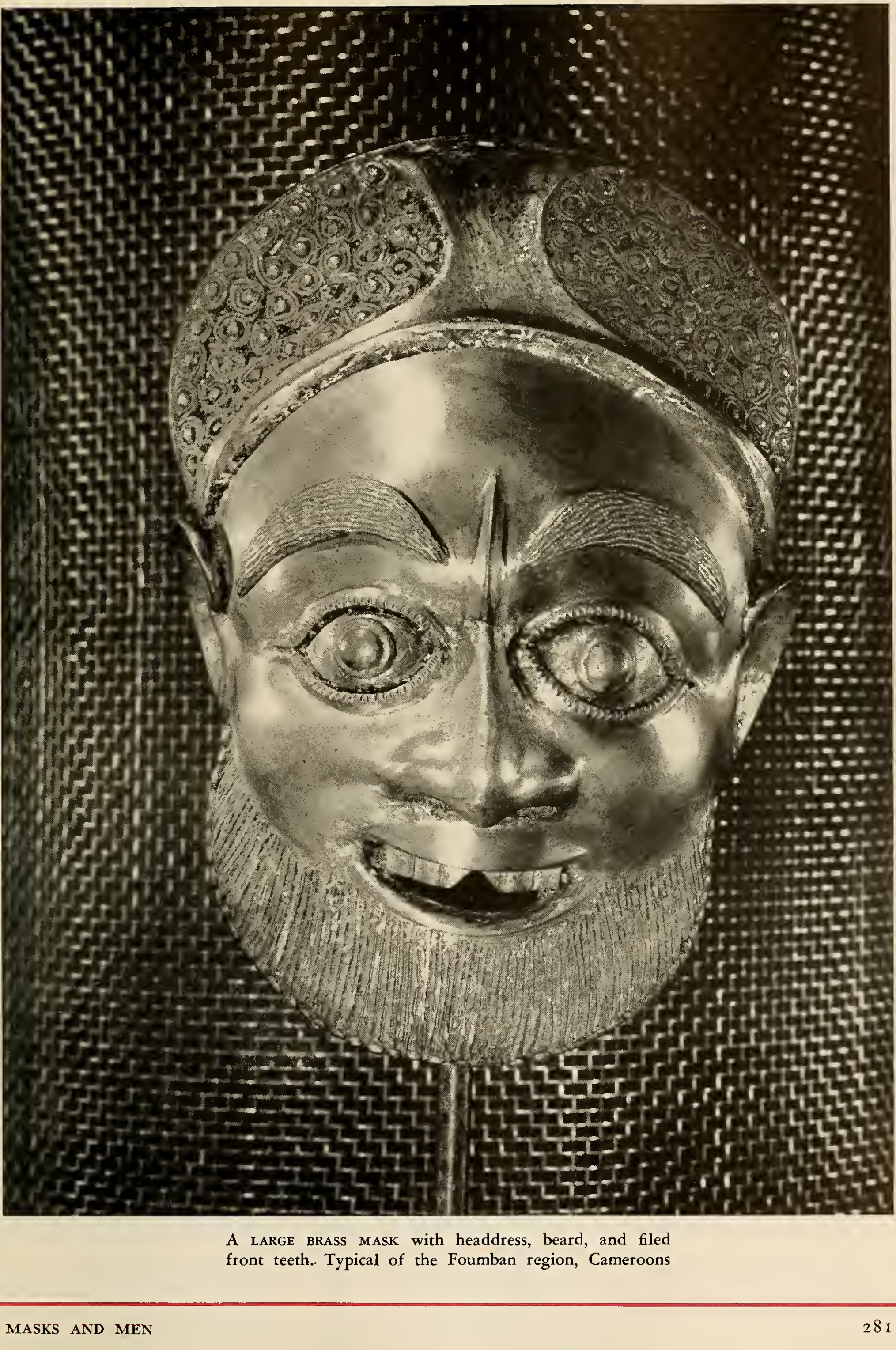
Masks are found all over the world, in so many different forms and in so many different uses that it is virtually impossible to think of mask-making as an invention that was made only once. Sometimes masks are used to help man imitate some spirit which he fears and hopes to control by assuming its appearance; sometimes to help him hunt by disguising him as the animals. Sometimes masks are used to permit groups of people, too weak as human beings, to enforce their will, either as police or bandits, upon the rest of the community.

in Africa

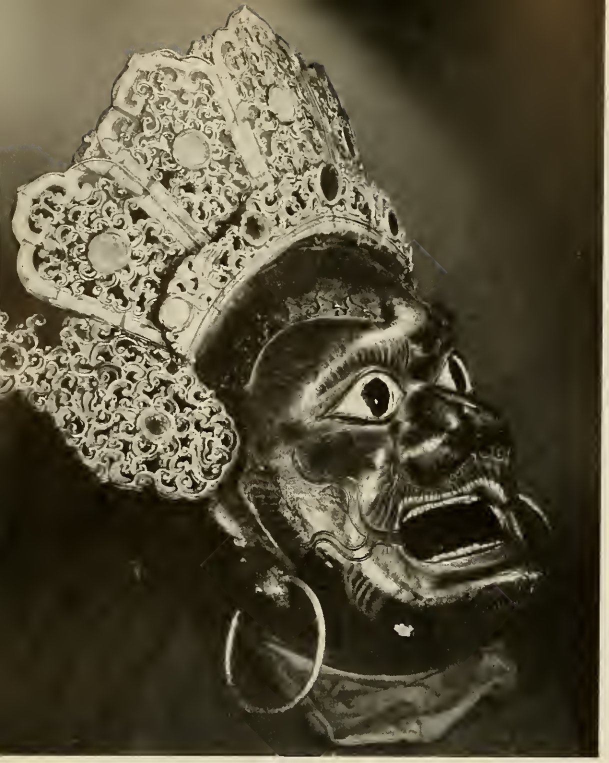
The People of Africa put masks to many magical and religious uses. Masks are worn in the rites of secret societies, in ceremonies initiating boys and girls to adult life, in war dances, and by medicine men in making magic and in curing the sick



➤ A bizarre fiber mask from Baluba, Kabanda



A LARGE BRASS MASK with headdress, beard, and filed front teeth. Typical of the Foumban region, Cameroons



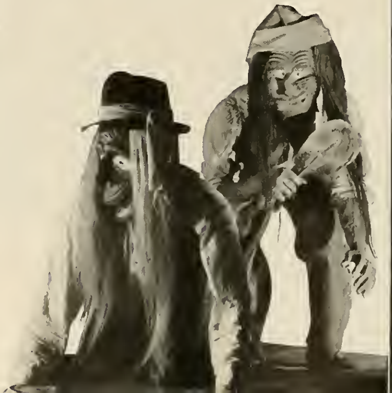
Tibet

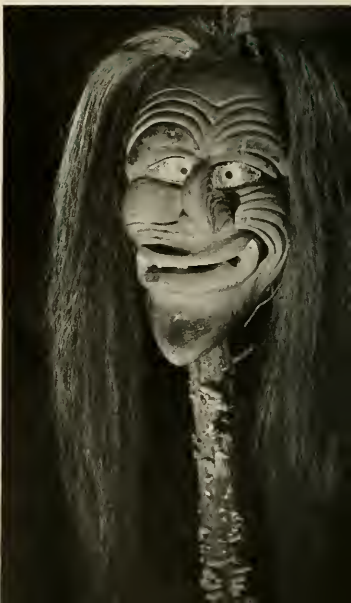
As part of Buddhist ritual, Tibetan temple dances are held to welcome the new year and to drive out the bad luck demons of the old year. These are Mystery Plays, enacted in the temple courtyard, in which Buddhist monks and lamas portray gods and demons. These vivid pageants show the power of lama and church over demon and human enemies

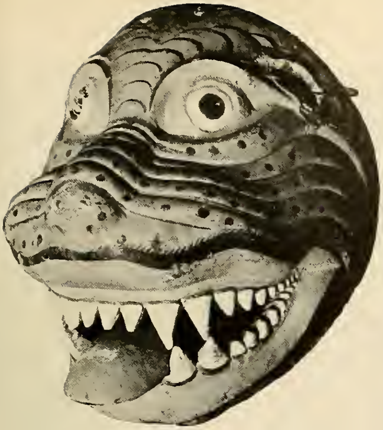
◄ The god of wealth, Nana-tos-ras

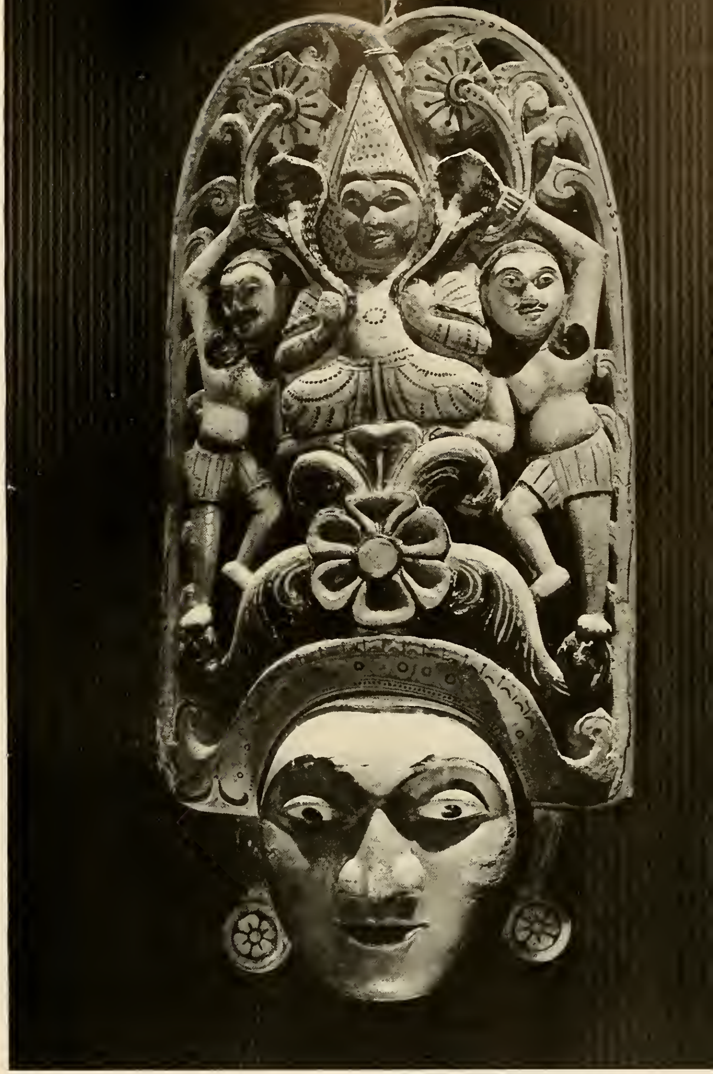
Iroquois false face dancers and masks

In the flickering firelight, the Iroquois dancers of the False Face Society put on terrifying masks like these to drive out the evil spirits believed to bring disease and misfortune to the village. A remnant of the ceremony is performed even today by Onondaga dancers, who suddenly appear outside the Council House, masked and wearing tattered clothes. They rattle their clubs and turtle shells against the outside of the house, while strange grunts and moans come from the frightful masks. As the dancers reach the entrance, the uproar becomes almost deafening. With a sudden push, the door is thrown open and the dancers enter, creeping and crawling on all fours and writhing like cripples. The masks represent bodiless demons which, if treated well, will give protection against the evil forces that beset mankind









DEVIL dancing masks from Ceylon

Ceylon

In Ceylon, masks are worn in the traditional plays and in dances to cure the sick. The theatrical masks represent stylized character types. The Sinhalese believe that disease is caused by devils, and a devil dancer wearing a mask is called in to make a cure. During the ceremony the drums and music grow wilder and wilder, and the dance more frenzied. The dancer faints when the demon leaves the sick man to enter his body. The dancer is then carried out as dead, and the patient is cured

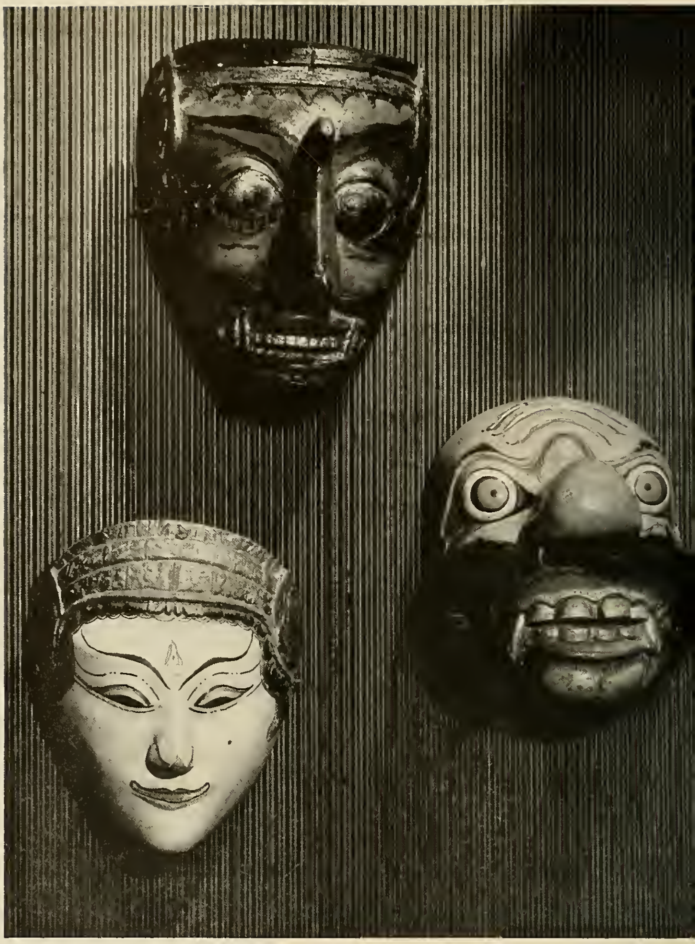
At other times masks are used merely for dramatic reasons: to raise the stature of man to greater heights, to give him godlike or demonic qualities, or to place on an actor's imperfect features a mask of perfect beauty or perfect ugliness. Clues for mask-making are taken from the accidents of deformity, from harelips, bulging eyes, or facial paralysis, while the idealized conceptions of human beauty developed in masks are reflected back in face-painting and actors' make-up.

Whenever masks are used, the community is divided into two groups, maskers and audience, and an extra dimension is added to the relationship of the workaday world. Those who wear the masks are able to assume new roles, to move with a license or a dignity, a ferocity or a frozen grace unattainable without a mask. The wearer of the mask reflects the terror or delight, the wonder or awe or panic in the eyes of those who were, until a few moments ago, his neighbors—perhaps his wife and children. His audience, responding not to him but to the mask he wears, gives him new clues, and he in turn becomes in feeling temporarily transformed into the creature whose image has been fashioned of wood or straw, of bark cloth or leather.

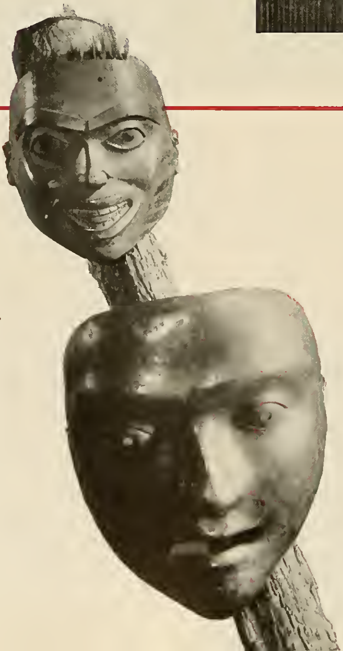
Occasionally the modern theater attempts to raise some scene above the ephemeral and mundane by the use of masks for the actors or as part of the stage set. In doing so we are able to draw upon our traditional knowledge of masks throughout history, to use again the creatures of the imagination of the primitive and ancient peoples of the world.

masks in the drama of Java

Two great epics of India, the Ramayana and the Mahabharata, provide the themes of Javanese dances. The same stories, characters, costumes, music, and gestures have fascinated generations of audiences in the courts of princes and wherever a group of traveling players could find a place for their performance. The type of mask indicates the kind of character portrayed—god or demon, elegant or coarse, good or evil



➤ HIGHLY COLORED Javanese masks of wood



North Pacific coast

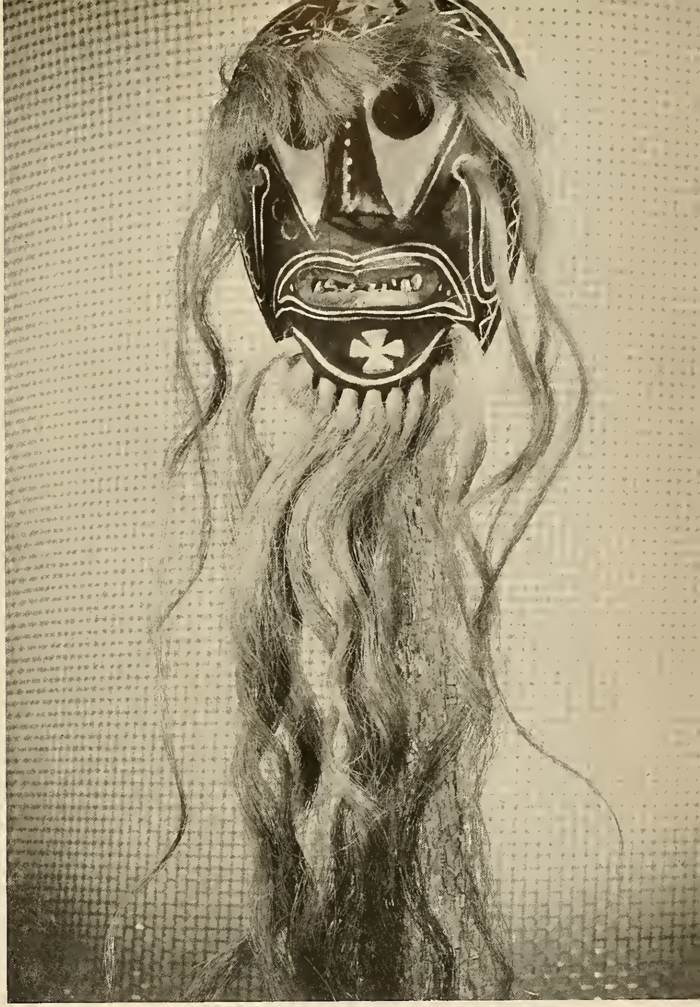
A STRANGE WORLD of the imagination comes to life when these Indians dance at night in huge, shadowy houses palely lit by yellow firelight.

The upper mask, coming from the Tlingit Indians, is part of a medicine man's equipment. The lower one, of beaten copper, is from the Haida Indians.

By startling and dramatic tricks, these dancers bring the audience face to face with their spirit ancestors. In winter, the secret society dances are the occasion for a blending of religious excitement and the gaiety of social life.

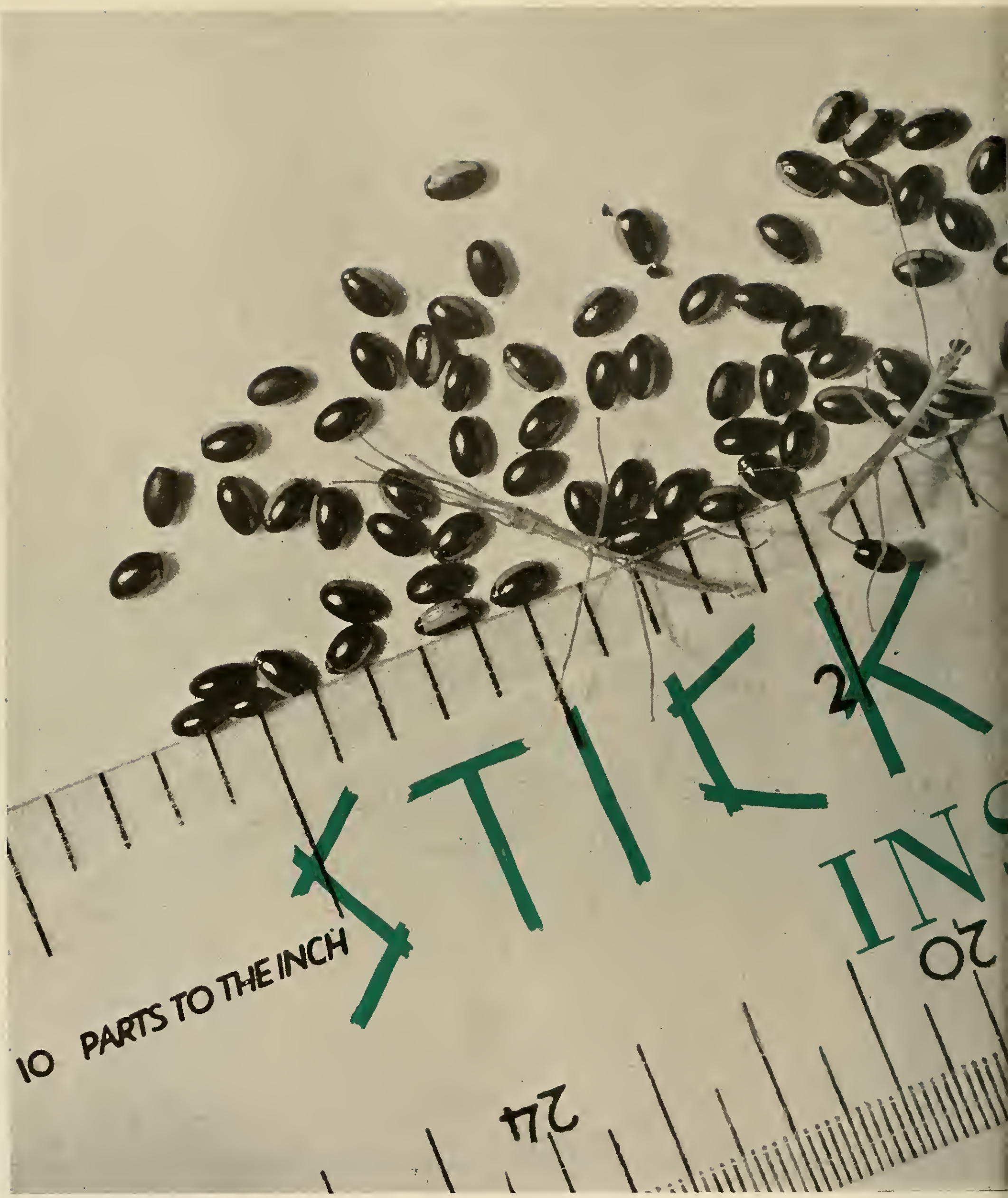
from the Yaqui Indians of Mexico

The so-called Pascola mask, of which this is an example, is worn on the back of the head and covers the face only for certain steps. The solo Pascola dance is like a very fast and complicated clog. But men also wear this mask in a dance representing the hunting of a deer, which is also impersonated by a masked dancer. The deer duplicates with great skill the actions of an animal feeding, wandering, sniffing the air, and taking flight. In interludes of clowning, the Pascolas burlesque the actions of the deer dancer with much slapstick comedy. The music of drum and flute accompany these dances. Today, new carnivals and processions showing the Christian influence have largely replaced the old Indian dances. These employ many masks and costly costumes, and are social as well as religious celebrations



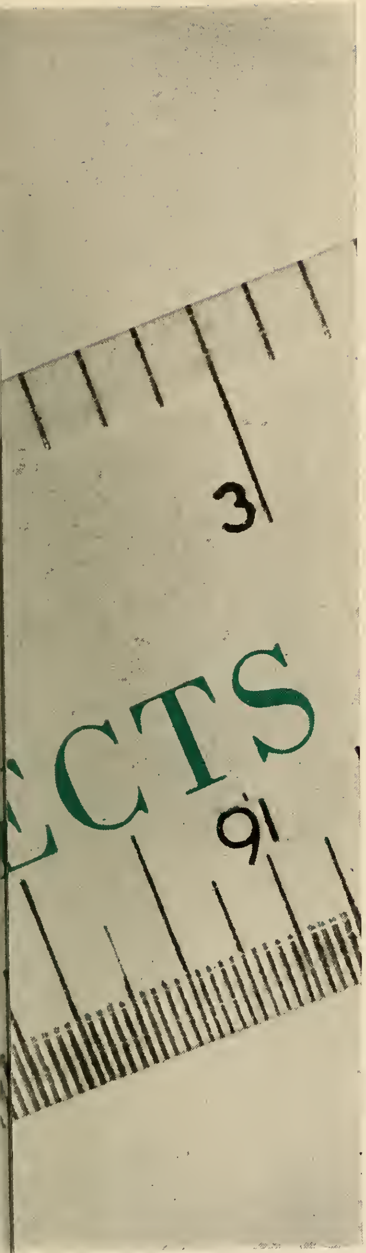
Masks are little used at present in the religious ceremonial of the western world, but they are still used to dramatize the hopes and fears of childhood, as Santa Claus masks, and witch and ghost masks at Halloween. They provide a framework for escape from the limitations of social conventions in the masquerade ball, and a cover for those who wish to enforce their will upon the helpless, as worn by the bandit, or by members of organizations like the Ku Klux Klan.

The arts of mask-making and masking, like all the arts, derive from human experience, but perhaps more conspicuously than the other arts because of the overwhelming reliance of the mask-maker upon the human face; they draw from human experience in the thousand forms that different civilizations have given it, and add to the complexity and richness of that experience. Man becomes a spectator of his own fears and hopes, embodied in grotesque or lovely forms, and in turn those fears and hopes become more manageable or more meaningful, but always more highly patterned.

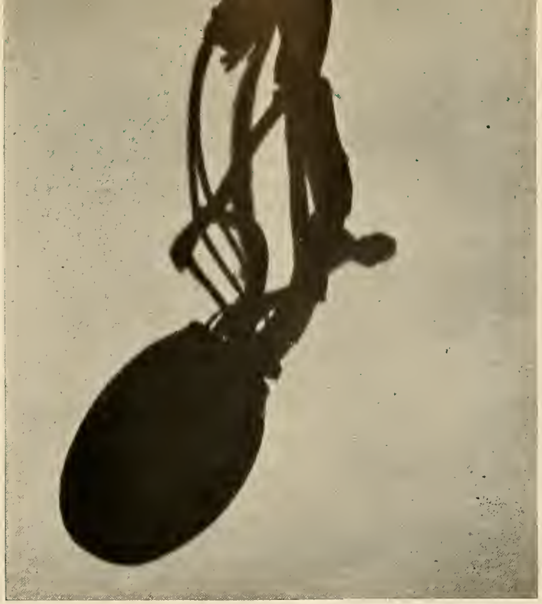

STICK
IN
10 PARTS TO THE INCH
2
20
24

A photo series by Lilo Hess   *Description by* John C. Pallister

They look so much like twigs that you may often have seen them without knowing it; but the camera discloses their curious life in intimate detail

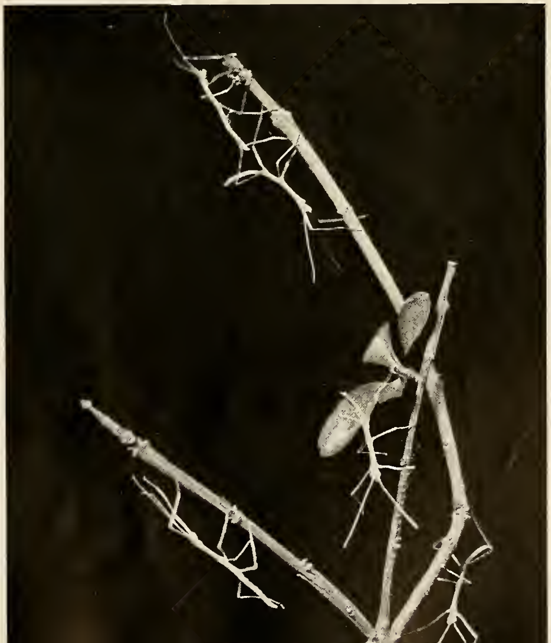


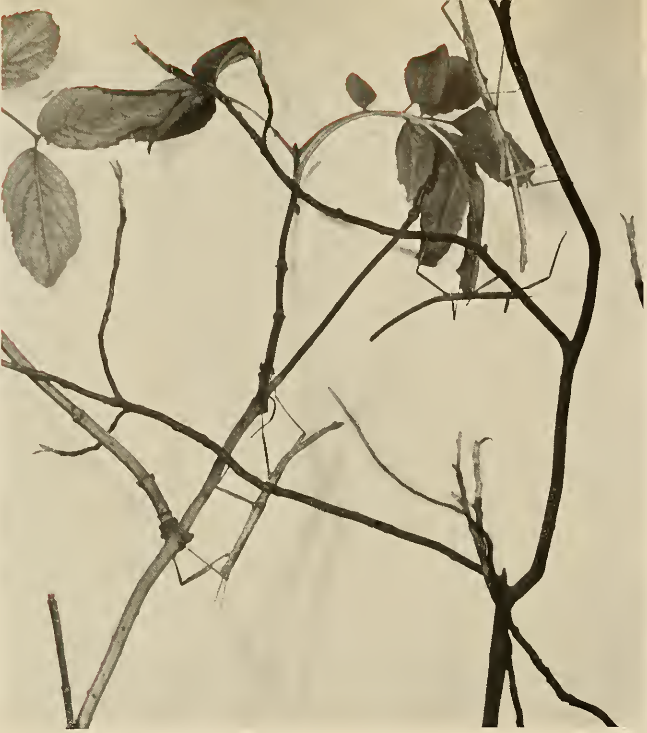
HAT LOOK LIKE seeds or beans in this ure are actually the eggs of the common ing-stick, *Diapheromera femorata.* About enth of an inch long, they are oval, pol- l-black in color, with a whitish area on side. All winter long they lie upon the nd among the leaves or debris where settled when dropped by the adult which resting among the twigs above



▲ ABOUT ONE HUNDRED eggs are laid by each female in late August or September. But in May (or sometimes as late as June or even July) a marvelous thing happens. A little cap at the end is pushed off and out struggles a weak and ungainly little baby. One wonders how such a creature of lengthy legs and body could ever have been fitted into such a tiny cell

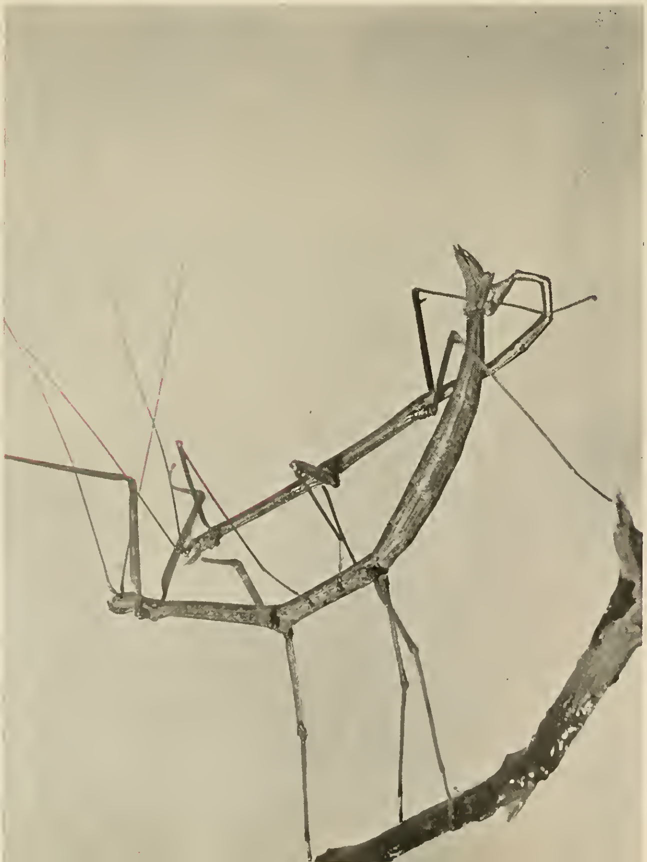
▼ WHEN THE YOUNG STICK INSECTS first emerge they are about one-quarter of an inch in length, greenish and quite wobbly on their legs, swaying as though they were in a strong wind. They soon commence to feed and rapidly grow in size. They prefer the tender leaves of oak and wild cherry but if pressed by hunger will feed upon locust, hickory, and to a slight extent upon witch hazel, sumach, and thorn





◂ IMMATURE WALKING-STICKS shed their skins about five times, increasing in size with each molt. Their feeding is as slow and deliberate as their movements among the foliage. They frequently pause for long intervals, looking like so many greenish, leafless twigs. Much to your surprise the twig slowly comes to life and walks off before your astonished gaze

▸ IN THE FALL, as the leaves turn sear, the now full-grown walking-stick puts on a coat of polished-brown. It rests among the twigs, and its forelegs and antennae, which are almost as long as its four-inch body, are frequently stretched out in front. The jaws are stilled, and only the eyes seem to glint with life. The time has come for the males to seek out the females



◂ MATING CONTINUES for a number of hours, sometimes ten or even twenty, after which the male goes off and shortly dies. In a few days the female begins to lay her first eggs, simply letting them drop into the leaves below. In an oak thicket infested with stick insects, the dropping eggs sound like rain drops falling. Egg laying is completed in five or six days, and soon after the female also dies. Thus the young never know their parents, but they are endowed at birth with all that it takes to live the life of a stick insect

SCIENCE at the CROSSROADS

The future of the earth and its human and subhuman life hangs in the balance as the world awaits scientific reports on the Bikini atom bomb tests

By Edwin D. Neff

When you read this, a few square miles of atoll and a comparatively brief stretch of blue Pacific in the Marshall Islands area will be under a scientific microscope in preparation for the greatest explosion since Krakatoa.

Under the sponsorship of the U. S. Navy, a preview of life on land and in the sea before the impending cataclysm is being prepared by scientists from the National Museum, the U. S. Geological Survey, the Coast and Geodetic Survey, the U. S. Fish and Wildlife Service, the Woods Hole (Massachusetts) and Scripps (California) Oceanographic Institutions, and the Universities of Michigan, Rochester, and Southern California. They want to know exactly what is going to happen biologically when the mighty atom bursts twice next month. To understand aftereffects, they must be intimately certain of beforehand conditions, a certainty which was impossible in the New Mexico, Nagasaki, and Hiroshima explosions.

The Bikini explosions provide nonmilitary science with the only ideal opportunity so far to learn just what atomic energy does to Nature. What the scientists are doing now is studying their "controls"—normal conditions in the area. This includes the waters immediately surrounding Bikini, the ocean currents in the Marshalls area, the land beneath the sea, and samples of all plant and animal life in the area, excepting only humans. Even this is not a complete statement, as will appear shortly. The undertaking is one to stop the breath and challenge scientific imagination. It is a "never before" project.

With the beforehand, or "control," picture as complete as possible, science will measure in the most precise terms possible just what the atomic bombs have done to Bikini and near-by areas. There should be little need for speculation about the effects of atomic explosion after Bikini.

The Navy feels there has been altogether too much speculation already, by the public, as to the effects of the Bikini tests. There will, of course, be death and destruction of land and life—subhuman life. But the selection of tiny Bikini, insulated by the vast Pacific (oh, classic misnomer!) will hold that type of destruction to a minimum. Then, the fact that the explosions will be above or beneath the sea will tend to reduce the effects of radioactive materials released by the bomb. Since water acts as a shield for radioactive materials, these effects will be less than in air, the Navy explains.

But to return to the present studies. Most interesting to the general public is the problem of commercial fish in the Bikini area, including tuna and bonita. U. S. Fish and Wildlife scientists, three west coast fishermen, and a Hawaiian fisherman, all professionals, are fishing these waters with the help of four Navy minesweeper-type vessels. Their voyages will include Rongirik atoll, which will not be affected by the bombs. In a recent report to the Navy, the expedition reported 143 species of fish in a single haul at Bikini.

The concept of measuring the effects of the bomb on fish populations began last November when Secretary of the Interior Harold L. Ickes pointed out to Secretary of the Navy James Forrestal the possible danger, and offered the assistance of the Fish and Wildlife Service in selecting a site of minimum danger. Bikini was named.

The intention is to estimate as closely as possible the number of fish in the Bikini waters prior to the explosions. Another count will be taken afterwards. Then it can be learned exactly, or to a very close approximation, the number of fish killed. One big difficulty in counting fish populations is the uncertainty about seasonal migratory habits of fish in the area. If the bombs explode just before the arrival of fish schools, then a false picture will result. The same is true if the fish begin to leave the neighborhood just before the bombs are put off. The best information available will be used to minimize error due to this variable.

Besides measuring fish mortality, the Fish and Wildlife men—as well as commercial fishermen—want to know the rate and extent of repopulation after the explosions, through reproduction and immigration. Later studies will determine this.

Samples of Bikini's atom-killed fish will be studied to learn the pathological conditions of the tis-

USAAF photo from Acme

sues resulting from exposure to radioactive materials. And the question of whether injurious effects of the bombing at Bikini will be confined to the fish of that area or imposed upon the Pacific stock in a broader sense will be investigated. To get the answer, the same species found elsewhere in the Pacific will be compared with the fish counted and identified in the waters neighboring the several atolls —Bikini, Rongirik, and Eniwetok.

Meanwhile, scientists from the Scripps Institution of Oceanography will be studying the plankton—the multitudinous plant and animal life upon which fish feed. This study will include an intensive survey of the Bikini lagoon and the open sea to windward and leeward. Similar areas will be surveyed at Rongirik and Eniwetok. Rongirik will be unaffected by the bombs, and Eniwetok, which is downcurrent from Bikini, will disclose the extent of the drift of radioactive materials. The studies now in progress will be repeated after the explosions to determine the effects.

One of the postbomb tests will measure the extent of fixation of radioactive materials in the plankton and other biologic materials eaten by fish, to determine the longtime effects on fish life. Like the fish studies, the plankton tests will be principally quantitative to disclose the extent of mortality.

A fascinating, but highly speculative, side light to the oceanographic-biological studies is the possibility of a change in the processes of evolution due to atomic energy. Will new forms of animal and plant life appear? Will there be extensive changes in existing forms because of radioactivity? Will the clock-hands of Nature be advanced? No one can say—yet.

How severely will the delicate balance of life, set by the hand of Nature, be shaken? Time will tell—perhaps.

Scientists from the Woods Hole Oceanographic Institution will be studying the effects of atomic explosion on the water itself. Direction and strength of currents and the net water exchange between the Bikini lagoon and the open sea will be determined by current poles, drift bottles, and dye markers in the lagoon, at its entrances and exits, and in the surrounding waters.

Water samples will be collected at the surface and beneath, and special instruments will be used to measure temperature, salinity, and other chemical characteristics in the lagoon and open sea, disclosing the depth of the mixed layers of water. These studies, together with the current surveys, will indicate probable diffusion. Information on wind, waves, tides, and weather will supplement that from other sources to complete the picture.

Something new in tracking ocean currents will be attempted with the co-operation of radiologists. Radioactive materials, distributed by the bomb, will serve to "tag" water currents. The water thus "labeled" will be tracked to determine its movement perhaps many hundreds of miles downcurrent.

Biologists from the National Museum and the University of Michigan have been assigned to the inventory of plant and animal life at Bikini, Rongirik, and Eniwetok. The inventories will be made prior to the bomb explosions and as soon as possible afterwards, as well as at varying intervals for a considerable subsequent period to discover any long-range effects. Shore and land animals, reef and lagoon fish, algae, and seed plants, will also be studied.

The technique used in the quantitative study of the atoll animals and plants will involve the cutting of a transect, or strip, about a yard wide across the atolls, and the counting and identifying of actual specimens. All groups of animals and plants will be represented, including parasitic worms inside the animals.

Perhaps we should stop a moment to think what the Bikini explosions will mean. Probably all life will be ended on the atoll, creating an absolutely sterile strip of seared earth and sand. Man will be setting up a starting point from which life, through immigration and evolutionary processes, will re-establish itself. In a sense it will be a de-novo animal and plant society, a microcosmic new world, a miniature rehearsal of an ancient story.

So thorough are the atoll studies, that even the coral will be scrutinized before and after the explosions. This work will be done by the University of Rochester and the U. S. Geological Survey. It should answer some puzzling questions. A coral atoll, insofar as it is coral, is a living thing. As the atoll base sinks gradually into the sea, or is slowly worn by the action of the water, the living coral builds up to compensate. Coral is a shallow-water organism. When the bomb strikes Bikini, it will become a dead atoll. Will it eventually wash away, vanish into the sea?

What is an atoll? No one is certain, and that is another question the Crossroads scientists may solve, quite apart from the bomb tests. Darwin thought an atoll was a coral fringe growing on the crest of a sunken volcano that once had thrust above the surface of the sea. Others believe the atoll base is an ancient mountain platform, or plateau, not a volcano. The question may be answered by an old oil-prospecting technique, called seismic prospecting. A pattern of explosives (not atomic) will be laid across the surface of the atoll and discharged, the resulting vibrations being carefully recorded by special instruments. These instruments will measure the travel times of the vibrations through the rock of the atoll, so that a graphic profile of the base on which the coral rests may be obtained. From the shape of this profile may be determined the atoll's origin. Sharply sloping sides will disclose a volcano, gentle slopes, an ancient mountain beneath the ocean.

Finally, the U. S. Geological Survey and the Coast and Geodetic Survey will conduct geological studies in connection with the program of oceanography and biology. Radiological effects on bottom sediments will be determined, and changes in the underwater topography will be mapped. Seismic vibrations in rock underlying the atoll may conceivably cause submarine landslides on the steep, outer face of the structure whose crest is the atoll, which in turn may set up seismic sea waves. These, however, will be mild and cause no damage, the Navy emphasizes.

This intensive program, costing hundreds of thousands of dollars, is financed for the most part by the Navy. When at last the results are in, they will be made known in a series of publications by the Navy's Hydrographic Office.

Bikini may do far more than tell what another war would mean, far more than settle the fate of future navies. It may be that the first pages of a new culture will be written there.

Insects in the House

THE ELM LEAF BEETLE

By C. H. Curran

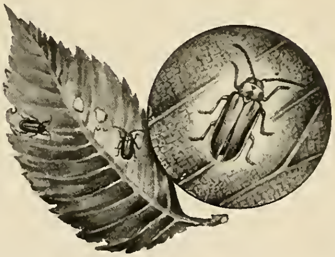
Associate Curator, Department of Insects and Spiders, American Museum of Natural History

THERE are relatively few insect pests of the forests that consistently enter houses in large enough numbers to become household nuisances. Chief of these, perhaps, is the Elm Leaf Beetle.

Our main concern with the Elm Leaf Beetle (*Galerucella pallida*) is the damage caused to our elm trees by the adults and larvae. When it enters the house, however, the Elm Leaf Beetle's nuisance value is fully as great. In the autumn, the adult beetles seek sheltered places in which to pass the winter while they await the development of leaves on the host plant the following spring.

Judging from the numbers of complaints received from householders during the winter and spring months, this insect's practice of hibernating in the walls of dwellings is increasing at a rather rapid rate. The beetles find small openings in the walls, often around window sills, and crawl in—frequently by the thousands. Later on, when the building is heated, the warmth stirs them to activity and they try to make their way into the warm rooms. Often it may take a month or two before they locate such an avenue, but once they have found one, there may be a steady stream of them,—from 10 to 100 or more entering each day. They do not harm anything in the house, but their presence is most annoying.

The household control of the Elm Leaf Beetle is usually difficult, but if the place of entry can be discovered and properly sealed up, the problem can be solved. However, it is not always possible to locate the opening; consequently the householder suffers all winter and spring. During the summer or early fall, the walls outside the rooms where beetles have been found should be closely examined and all cracks sealed. In the summer, additional precautions should be taken, in the form of a poisonous spray, to kill the insects feeding on elm trees.



◂ Living Elm Leaf Beetles are greenish-yellow with a black stripe on each side and black spots on the head and thorax

THE GREAT TIDAL WAVE OF 1946

Continued from page 268

3. A large naval vessel to be used for trawling and for securing cores of rock from the bottom by drilling and by the use of explosive charges in progressively deeper water.

4. The creation of a large floating laboratory based on the principle of the Armstrong sea-drome—larger than the largest aircraft carrier and rendered stable against storms by deep, counterpoised floats. Such a unit could conduct intensive research at selected spots and would prove valuable throughout the seven seas.

5. The studies to include measurement of submarine rock heat at different localities, seismometry, gravity, magnetism, earth electricity, and earth radiation.

6. And special investigations on the bottoms of *shallow* oceans, as for example in Bering Sea, into which the gold beaches of Nome extend, and on the oil beaches of Texas. A special submarine might be devised for this work, capable of undertaking direct quarrying of the sea floor. It would be equipped with buoyed hose for air supply, searchlights, watertight observing ports, and electrical machines operated from within for direct drilling.

Postwar economic consideration on these lines extends far beyond safety from tidal waves. It concerns the making of new jobs by new methods of exploration for adventure-loving young men and women. This is William James' "moral equivalent of war." The rapid advances made during the past few years in the fields of transportation, communication, electronics, and in the development of new materials and techniques should be applied in this direction as well as in other fields that come more readily to mind; there are no needs more pressing than the exploration of the ocean bottom. Endless possibilities will be open in sea-bottom exploration when geology directs the most up-to-date techniques to the now unknown 72 per cent of the earth's surface.

THE STORY OF THE ROSES

Continued from page 275

taste for roses as a young man studying under DuPont. He started his nursery in 1810, and while his hybrids ran mostly to Gallicas and Bengals, he did produce some beautiful Noisettes. In 1835 he introduced Cramoisie Supérieure, a *R. chinensis* hybrid produced by a neighboring amateur. It is still listed in at least one American catalogue. From 1816 on, M. Vibert issued catalogues of his roses which today prove valuable check lists. He is also remembered for his Essai sur les Roses first published in 1826 and reprinted in 1830.

Another horticulturist was Narcisse H. F. Desportes, who has left us three valuable monographs: Rosetum Gallicum, ou Enumération Méthodique . . . (1828), in which he attempted to classify the roses produced by Descemet prior to 1815; Roses Cultivées en France, au nombre de 2,562 Varieties (1829); and Flora de la Sarthe (1838).

J. Prevost, a nurseryman and rose specialist, with twelve acres under cultivation in Rouen, found a good market for his hybrids in England. His catalogue of 1829 is a valuable and comprehensive book. It would put to shame the highly adjectival rose catalogues of today, which are concerned mostly with publicizing only the ephemeral catch-penny novelties. For several years the Prevost firm was carried on by his son.

Auguste de Pronville was an indefatigable rose authority. He began in 1814, four years after Josephine's roserie had been completed, by contributing a paper to the Annales de L'Agriculture Française on the names of species, varieties, and subvarieties cultivated in gardens in and around Paris. Up to that time Paris was the rose center of France, the industry not yet having moved to Lyons and scarcely begun at Rouen.

Among the nurseries that helped carry forward Josephine's dream to make the rose the first flower of France, we find the name of Laffay, a florist and nurseryman whose gardens were at Antéuil, near Paris, where the soil, a rank clay, was especially favorable for rose growth. He produced several admirable varieties of *R. banksia* and is remembered for the first Hybrid Perpetual.

In Rouen, beside Prevost, were two other good rose nurseries—the Vallant Nursery, which was devoted solely to orange trees and roses and which introduced several kinds of the latter into England; and the Trianon Nursery. The Trianon was started by an Englishman named Calvert, from London. It was then believed that the climate and soil of this part of France were the best to hybridize and start roses and England the best place to grow them to perfection. Mr. Calvert raised many new varieties of Noisettes. The extent of his rose growing can be surmised from the fact that when destructive pests wiped out Vibert's nursery, they destroyed over 50,000 rose bushes in Calvert's.

Meantime at the Luxembourg, André DuPont having died in 1817, M. Hardy became keeper of the garden and for 25 years continued sowing rose seeds obtained from all parts of the world. This was considered the most scientific roserie in Europe. The plants from this garden and from the smaller public one at the Trianon were distributed to distinguished amateurs and nurserymen or exchanged for other plants. The recipients, when they had raised sufficient stocks, put them into general circulation.

What was the actual result of all this enthusiasm for the rose that Josephine stirred up? Whereas in 1810 only 250 species and varieties were available, by 1828 the named varieties on the market had leaped to 2,500, and by 1845 to over 5,000! Nurseries specializing in roses sprang up, and a lively trade was developed both on the Continent and in England. All of this progress came within 30 years after Josephine's death. True, there was much duplication among these 5,000 roses. The same rose would be distributed under half a dozen names.

Let us conclude this sketchy story of the Rose with a scene from Josephine's garden.

June 24, 1815. It is near the close of the Hundred Days. Napoleon is dining in Paris with Hortense. Josephine dead a year, Malmaison is now Hortense's. Napoleon expresses a wish to see it again. Would she permit him to visit it? Of the few remaining days of his life as a free man, Napoleon was to spend five at Malmaison. Immediately after dinner he started out. Most of that first night he wandered around the gardens. The next morning, standing before a bed of Josephine's roses, he remarked, "Poor Josephine! I cannot accustom myself to living here without her. I seem always to see her coming along the path and picking one of these flowers she loved so well. Truly, she was the most graceful woman I have ever seen."

Photo by Hubert A. Lowman

▲ THE EEL RIVER, on California's famed Redwood Highway, in the heart of the coast redwood forests

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LETTERS

Continued from page 248

the Federal authorities have not been able to make the proper cuts in cattle population, a statement with which I cannot agree.

The chief difficulty that the Forest authorities have had is that in all these 40 years they have not secured the co-operation of the cattlemen. The main reason for this has been the constant and impractical interference by Washington bureaucrats in the local forest management. There has been a constant shifting of policy and an adherence to one bad policy, namely, making a number of cattlemen graze on the same range. In other words, they do not say to a cattleman, "This area is yours during good behavior on your part. Fence it in and take care of it. If you harm it, you will be put off. If you protect and improve it, you will be allowed to increase the number of cattle you may run on it."

On the contrary, they put from two to several cowmen on one range, so that no one of them can have any real responsibility for what happens to it.

The forest supervisors I have spoken to (incidentally, they are a fine lot of men), would much prefer individual responsibility, but they are overruled by Washington.

Let me give an example of a ten-year permit issued in the 20's. A single user was allowed to fence a certain range and during the life of the permit had exclusive use of the enclosed area. Like a great majority of cattlemen he preferred a range that would keep his cattle alive and in good condition to one on which they would starve to death, so for a time he deliberately kept the number of his cattle under that permitted to him, to allow the range to reseed and get in good condition. This is an expensive thing to do, but a safe range is of fundamental importance to a cowman, as he knows better than anyone else. At the end of the ten-year permit, this range was admitted by the Forest authorities to be considerably improved, but on orders from Washington, against the judgment of the supervisor, the number of cattle the permittee was allowed on this area was reduced and a permit for the amount of the "cut" was given to another cattleman to run his cattle on the same range.

With things like that happening on every National Forest, you don't achieve much spirit of co-operation between the Forest authorities and the cattlemen. And you don't encourage the cattleman to take good care of his range.

Consider also that a cowman needs exclusive control of his range. Fred A. may want to improve his herd. He buys good bulls and plenty of them. Bill B., whom the Forest has placed on the same range, buys a few grade bulls and counts on his cows making themselves attractive to his neighbor's finer animals. Fred A. buys plenty of salt for his cattle, while Bill B. puts out little if any. Fred A. is particular to handle his cattle gently and keep the fat on them. Bill B. likes to "chouse" cattle and runs a bunch of Fred's fine cows for miles before he can rope one of his own that is in the bunch. And so it goes.

This is, of course, an extreme example, but the aggravations of joint use are many and the responsibilities negligible.

The State of Arizona leases its grazing lands to individual users, and by custom the land is theirs as long as they pay their leases. Not all State land is well cared for, but it is a known fact that ranches having State lands are valued higher than ranches having Federal lands. Anyone familiar with the Arizona ranges will admit that State lands as a group are in far better condition than Forest lands.

Mr. Carr concludes that, "a great war has been fought and won to protect coming generations from want and privation." Also we hope from bureaucrats. It is just possible that if there were fewer bureaucrats, there would be less want and privation.

Something should be done about these Forest lands. Maybe the cattlemen and Forest supervisors should be allowed more say in their use. Maybe the lands should be turned over to the States in which they are located. Mr. Carr's article is pretty good evidence that the present system of complete government control has not worked any too well.

THOMAS M. PETERS.

New York, N. Y.

* * *

SIRS:

I have read Mr. Peters' letter with interest. His remarks about range conditions here in Arizona are quite sound wherein he mentions the need for a more equitable system of range management. However, when he advocates return of Forest controlled lands to the State and further writes that, "Anyone familiar with the Arizona ranges will admit that State lands as a group are in far better condition than Forest lands," then I must disagree with him most heartily. The State grazing lands that I have examined are far from being in better shape than the ones found under Forest Service control. In fact, I have seen State lands that, through many years of terrible neglect, are in the very poorest condition one could imagine. It would be nothing short of a national calamity to return Forest lands to the State.

The cattlemen are far from the blameless, ill-used people Mr. Peters' letter would indicate. Many of them will agree to my statement, for many of them have followed Forest Policy to the letter and have profited thereby. The Santa Rita Range Experiment Station, located near Tucson, Arizona, is the oldest station of its kind in America. Here cattlemen cooperate with Forest Service researchers, with the result that some of the finest herds of cattle in the country are produced, and the range does not suffer. Let anyone who has any question as to the relationships between cattlemen and Forest Service personnel investigate the management of this range before he condemns the operation of the Service in this area.

WILLIAM H. CARR.

Tucson, Arizona.

* * *

SIRS:

On Caton Island in the eastern Aleutians, thirteen Alaska fur seals were found dead on the beach, July 15, 1934. On the same island, 40 fur seals were found dead on July 3-5, 1941. The cause of their death is a mystery. A submarine fumarole releasing a sudden burst of hot gas might have killed the seals as they were swimming in shallow water. Does any reader know of an observation of fish or seals killed in this manner?

VICTOR B. SCHEFFER,
Biologist.

University of Washington,
Seattle, Washington

* * *

WHAT DO YOU THINK?

For about three years it has been the custom of my wife and me, along with other tenants of the Priscilla Apartments in the northeast section of metropolitan Miami, to sit out the last hour of twilight on the veranda, enjoying the cool of the tropical evening. We often noticed and commented upon the fact that flocks of common sparrows came in to roost in the overhanging fronds of the two tall, naked-trunked Washingtonian palms in the parkway in front. This thatch of dried fronds seemed to form a favorite roost for the sparrows, and also for several bats that went out at the first dark, when the sparrows came in to roost. .

One evening, about one hour after dark, while three ladies were sitting on the veranda, their attention was drawn to the top of the palm tree directly before them by a frantic scream and loud fluttering. Suddenly something came tumbling down and landed with a dull thud on the concrete pavement. The ladies, thinking it was a young bird fallen from its nest, rushed to its aid. The distance was only about 20 feet, so no time was lost. They were shocked and amazed to see only one wing of a sparrow protruding from the coils of a snake. The fall had temporarily dazed the snake, so the girls picked up a board and struck it several times, taking care not to smash the sparrow. When the snake uncoiled, they dispatched it with several more blows and tossed it into the street. The sparrow, released from the coils of the snake, at first seemed dead and lay quite motionless. But after a few brief seconds, it revived, stood up, shook itself, and flew away, apparently unharmed by its experience.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $1.00 each, with full credit to the photographer. Return postage must be included.

Being somewhat of a naturalist, I could not believe it possible that any kind of snake could climb the smooth, straight trunk of a 40-foot palm tree; yet I definitely established the fact that it could not have fallen from any other near-by elevation. The snake may have lived up there since the tree was a mere shrub near the ground,—which was a great many years ago—, or it could have been dropped into the top of the palm by some bird of prey and lived there ever since, quite happy and unmolested, feeding on the young and old of the nesting sparrows and supplementing this diet with palmetto bugs, moths, and other insects.

What do you think?

W. B. GRAY.

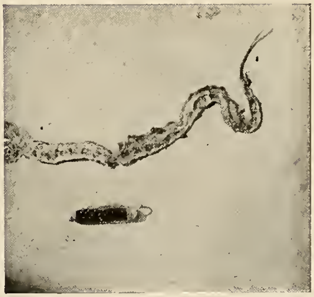
Marineland, Florida

* * *

The following comments are offered by Dr. James A. Oliver of the American Museum's Department of Amphibians and Reptiles.

Mr. Gray's hesitancy to give credence to the snake's ability to climb the tall palm is not surprising. Frequently even professional herpetologists are amazed at the agility displayed by snakes in scaling seemingly impossible heights. The snake involved in this observation (to judge from the photograph that Mr. Gray sent of the damaged individual) is the Corn Snake, *Elaphe guttata*, a serpent that is a good climber. It is commonly active in the evening or at night, and is known to feed on birds as well as mammals. Undoubtedly the snake climbed "the smooth, straight trunk of a 40-foot palm tree" and fell from the tree in the process of eating the sparrow.

Some species of snakes climb better and more readily than others. Those that habitually live in bushes and trees have structural features that enable them to climb more readily than their ground-dwelling relatives. Three of the more important of these modifications are: the relative elongation of the body and tail,



whereby the weight is distributed over a long expanse; a longitudinal keel or ridge on each side of the belly that enables the snake to utilize minute crevices or irregularities; and a lateral compression of the body that affords increased rigidity when an unsupported part of the body is extended into space, as in getting from one branch of a tree to another.

When the snake is long enough to reach well more than halfway around the tree, it climbs by gripping the trunk with a loop or coil of the body. When the front part of the body secures a grip, the hind part is pulled up to get a higher grip, and then the front of the body is pushed up. By this action, the snake is able to ascend such smooth objects as ordinary metal piping or bamboo.

If the diameter of the tree is too great for this method, the snake climbs in a zigzag fashion by utilizing irregularities in the trunk. It is here that the keels on the sides of the under surface are most valuable, enabling the snake to take advantage of the smallest crevices. It is not uncommon to find our native rat snakes and king snakes in large trees, such as elms and oaks. Whether they venture into trees in search of birds is a question. I once found two king snakes up in a large elm feeding on whitefooted mice.

It is not impossible that, as Mr. Gray suggests, the snake was dropped into the top of the palm by a bird of prey. However, the numerous improbabilities involved do not make this a likely explanation for the occurrence described here. The proposal that the snake might have lived in the palm since it was a mere shrub is highly improbable. The explanation that is more in accord with our knowledge of the natural history of snakes is that the snake climbed the palm, probably in search of food.

* * *

WISENT

In response to a brief discussion of the postwar status of the almost extinct European bison, or wisent, in the March NATURAL HISTORY, the following letter has been received from the Duke of Bedford:

April 29, 1946.

Sirs:

. . . It is stated on good authority that a small pure-bred herd of European bison, containing several young females, exists in Germany and is being protected. There may be another small herd in Poland, two or three in Sweden, and about the same number in the Zoological Gardens at Amsterdam. In England there are 21, of which I have 20, but I am sorry to say they have bred badly for many years and only one or two living calves appear in any season. A heifer was born yesterday and I hope it will survive. We have never had any cross-breds.

One curious difference between the American and European bison is that the European calf is dark brown at birth, whereas the American calf is yellowish-red. The European bison is a more silent animal than the American, though the voice is somewhat similar. Both species enjoy rolling in the dust as well as in the mud.

Incidentally, I am hoping in a few months to send to America some Père David's deer so that the species may be conserved there in the event of some disaster overtaking my herd. This strange deer, totally unlike any other variety, has never been seen wild by Europeans and is extinct in China, where it was first discovered in the Imperial Hunting Park in Pekin. For nearly 40 years the Woburn herd, latterly numbering between 200 and 300, has been the only one in existence.

Bedford.

Woburn, Bucks, Bletchley,
England

* * *

Sirs:

Perhaps my question is ridiculous, but I should like an authentic answer. Was the red fox a native of North America? In various books, which pretend to be scholarly, I have seen it stated that it was imported from England in the eighteenth century, and that our only "native" was the southern gray fox—which I doubt. Am I right?

Alexandria, Va.

Roger Warner.

The following answer is offered by George G. Goodwin of the American Museum's Department of Mammals:

Philosophers tell us that human thought creates that which it imagines. The cunning, deceitful, cowardly creature known as the fox might well be considered a product of the imagination, as no such animal exists. From infancy man is taught a legendary version of wildlife, handed down through the ages; and there is little hope that this teaching will not be fed to future generations. Regrettable indeed is the fact that most so-called nature writers of today are themselves ignorant of the true characters of wild creatures and can do little to enlighten the public.

The fox is one of the most familiar animals figuring in children's stories, natural history books, and illustrations for advertisements; but always he is shown in a deporable light.

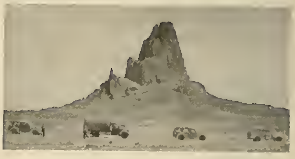
Just how easily the public can be misinformed is shown by this letter. The writer is honestly in search of information, yet the vague date handed to him is such that, if he were not cautious, it might lead him to believe that the gray fox is the only species native to North America.

There are five distinct species of foxes in North America, including no less than three genera or widely separated types. In America we have approximately as many different kinds of foxes as there are in the whole of Eurasia or Africa. The commonest and best known is the native American red fox. The silver fox and the cross fox with the cruciform markings are both color phases of the red fox. In the cool regions of the extreme north there is the Arctic or white fox which has a color phase in blue. Then on the prairies of the Middle West is the little kit or swift fox, and on the deserts a big-eared fox. Perhaps the most remarkable of all is the gray fox, which can actually climb and shin up a tree trunk much like a schoolboy.

It should be borne in mind that foxes render a valuable service to mankind by helping to control the ever multiplying hordes of rodent pests. The red fox has successfully pitted his wits against man, and despite the price set on his valuable coat of fur he still maintains much of his former range even in populated districts. For this he is branded as deceitful and sly. Because he has sense enough to avoid a man armed with a double-barreled shotgun or to run from a pack of dogs and overwhelming odds, he is deemed a coward.

Anyone seeing a fox, especially a red fox, must wonder at his enormous tail. He has without exception the most magnificent brush in all the mammal world. For a runner like the fox such an adornment would seem to be more of a hindrance than a necessity; yet that very brush is of vital importance to him. The red fox belongs in a country of bitter cold winters, and since he does not use an underground retreat except when raising a family, he makes good use of this protecting wrap. On retiring, Reynard curls himself up and draws his feet and bare nose together, snugly winding his warm brush around himself.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.



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HILLIS L. HOWIE
School Service Department
Peabody Museum of Natural History
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ptember **NATURAL HISTORY** 1946

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IME LV, No. 7 FIFTY CENT

animal, vegetable, mineral

THE little metal animal paper-weights, which were practically extinct for a few years, have returned, and we keep adding to our menagerie. The selection is still rather small, but in a few months we expect to have most of the old ones and quite a number of new ones. The ones at 55 cents are approximately 1 to 2 inches high: the $1.00 ones about 2 to 3 inches, and the $1.50 size 4 inches.

The Hardness Scale is a new item: the specimens are about 1 inch thick. As an afterthought, we included the Flower Cards. These little postcards may be used for any occasion and are very handy to have around the house when you feel you must send someone a note and have no time to dash out shopping around at the last minute.

If you visit the Museum, come into our Book Shop and browse around. You might have fun, and you might also find just the thing you have been searching for and never thought you would find.

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LETTERS

SIRS:

I should like to subscribe to your . . . NATURAL HISTORY Magazine.

For your information, I made my first acquaintance with your periodical at the time when some American internees in Java were transferred to another internment camp and left some copies to me. Those issues have survived the many surprise searches made by the Japanese in our camp; and in the days I suffered of starvation and diseases, the periodicals became real friends and they remained so up to now. My love for nature gave me spirit, and though I read the articles again and again they never bored me but gave me diversion to appreciate life. I am convinced that they helped me to leave camp with a sound mind . . .

G. A. SOMBEEK.

Schiedam, Holland.

* * *

SIRS:

I was interested in W. B. Gray's letter (June, 1946) on the climbing powers of snakes. Last year I captured a common gartersnake 18 inches long and put it in an empty fish tank on the windowsill until a more suitable container could be provided. A wire screen was placed over the tank and weighted down with a large dictionary. The next morning the snake was nowhere to be seen.

There was a great deal of excitement; a search of the apartment revealed nothing. A few hours later, however, I chanced to lower the Venetian blind over the window, and the snake fell out of his hiding place atop the uppermost slat. The only way the snake could have gotten up there was by climbing up six feet of $\frac{3}{16}$ inch cord.

The snake was then placed in the tank and watched. He (it was a male) squirmed out of the tank, and with no hesitation at all made straight for the cord and climbed right up it, reaching the top (after many slips and slides) in about two minutes. The cord had no knots or twists that might have aided the snake . . .

MARK BERENSON.

New York, N. Y.

* * *

SIRS:

Something happened this morning that seemed stranger than fiction! While phoning from the ninth floor of our 68th Street apartment, I looked out on our terrace and saw a large park squirrel! How he got there is a mystery.

He seemed so inquisitive and friendly that I offered him various tidbits. What made the greatest hit was some peanut brittle from Savannah, Georgia. He could not get enough of this and kept nibbling away for over an hour, despite the presence of our Belgium schipperke, who seemed to welcome the visitor.

One solution to the mystery of his lofty appearance might be in the outside fire escape belonging to the Institute for Deaf and Dumb Children which adjoins our apartment house.

We are confident that he will return, if only to recover the pecan nut he cached under our weeping willow tree . . .

MRS. B. H. NAMM.

New York, N. Y.

Squirrels are frequently seen in rather unexpected places, and it is not impossible that this one might have climbed up the wall. The fire escape offered an easy route for him, and even a brick or stone building usually provides many footholds for an animal no heavier than a squirrel.

The nearly vertical-sided Devil's Tower in Wyoming (described in NATURAL HISTORY for November, 1942, page 205) is almost as difficult to climb as an apartment house wall; yet when the top was first explored, chipmunks were found making their homes on this natural skyscraper.

Shiva Temple, one of the most isolated rocky formations in Grand Canyon attracted a great deal of attention a few years ago. A press agent, whose imagination ran away with him, visualized a "Lost World" on top of this precipitous peak, with ancient types of animals living in seclusion there. Actual exploration showed that pack rats, chipmunks, mice of several sorts, not different from those of the main plateau, lived on the rock, and even some of the larger mammals, such as the bobcat, had climbed it.

JOHN ERIC HILL,
Assistant Curator of Mammals.
American Museum of Natural History,
New York, N. Y.

* * *

SIRS:

The accompanying photograph shows two curious white oaks growing in our neighborhood in Waukesha County, Wisconsin. They stand about 20 feet apart, and both point west. I have long suspected that these trees were crippled in this manner by Indians who used them as markers. But I have had no success in verifying this explanation and would appreciate it if you could give any opinion.

C. P. FOX.

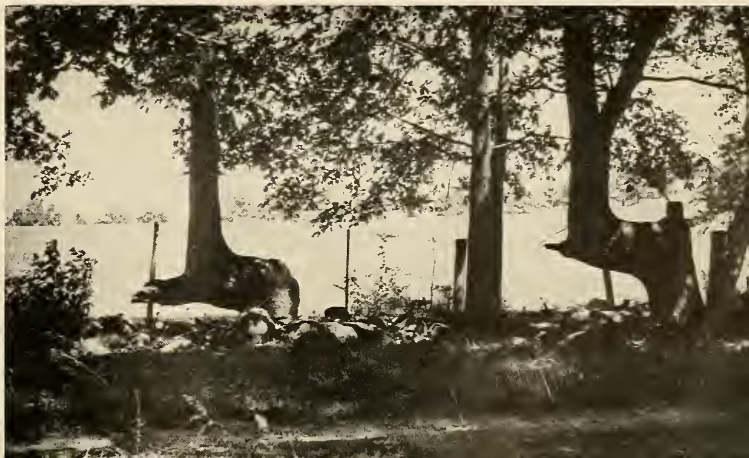
Oconomowoc, Wis.

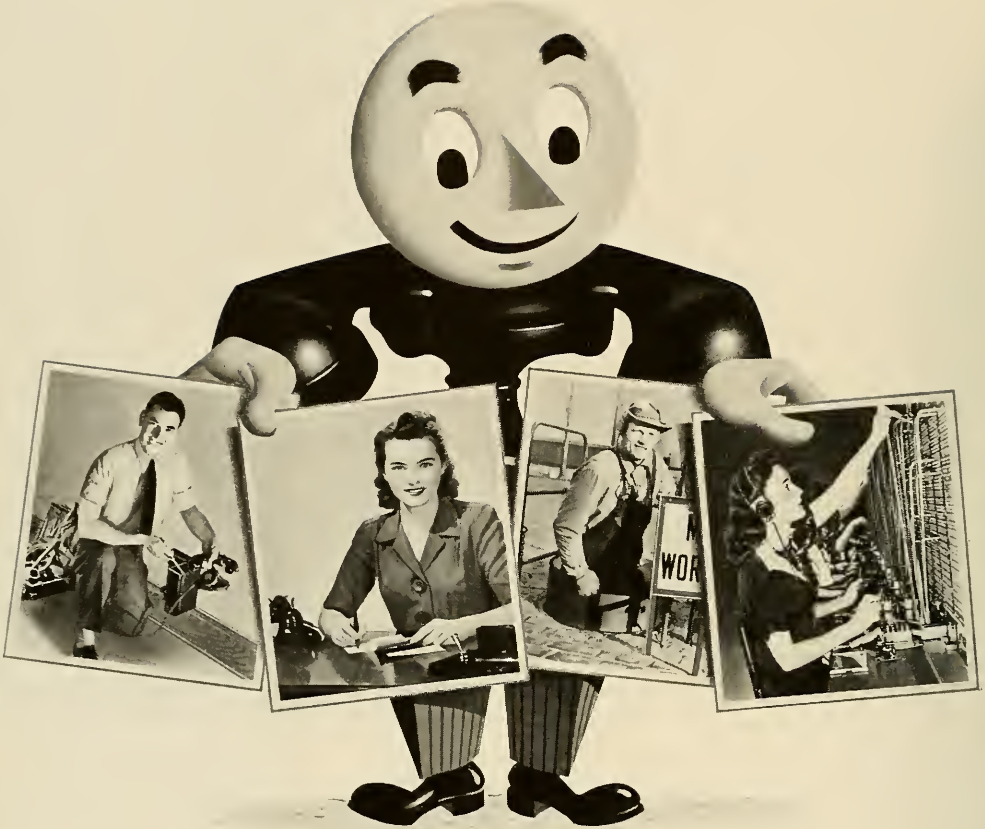
Mr. Fox's theory is indeed likely to be correct. As explained in an illustrated article by Dr. Raymond E. Janssen in NATURAL HISTORY for February, 1940 (page 116), many trees deformed in this peculiar manner have been found. The Indians had the custom of bending saplings over and fastening them in position by means of a tough vine or piece of rawhide so that the direction of the bend would indicate the route to be followed. Care was taken not to break the trees, and as a result they continued to grow in the deformed position. The tree would then send up new stems, or secondary trunks, and the original branches would die and decay, leaving this strange "arm and elbow" appearance.—ED.

Continued on page 342

CURIOUS TREES: If you are as good a woodsman as the people who first made use of these trees, you should know why they have taken this curious form

C. P. Fox Photo





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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President ALBERT E. PARR, Director

VOLUME LV—No. 7 **SEPTEMBER, 1946**

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You will find NATURAL HISTORY Magazine indexed in *Readers' Guide to Periodical Literature* in your library

THE COVER THIS MONTH

This Kodachrome, taken by Tad Nichols, shows a spectacular sight unfamiliar to most persons outside of the tropics—the gorgeous blossom that adorns a stalk of growing bananas. It also shows—likewise unknown to many—that bananas grow "upside down," that is, pointing skyward. When they first appear they are quite small and point downward, but as they mature they turn upward. The stalk usually hangs inverted in the fruit store.

The banana is perhaps the largest plant on earth not having a woody stem above the ground. About a year after the rootstock is planted, the "tree" has attained a height of from 15 to 30 feet. The stem that is to bear the bananas emerges from the top of the trunk and produces a flower bud that grows and bends downward. The bracts then drop off, disclosing the young bananas, which originate from clusters of flowers arranged spirally around the stalk.

Occasionally a bunch is produced with more than 300 individual bananas, having a total weight of 150 pounds, but a bunch with 150 bananas, weighing 60 pounds is more common. About 85% of the "tree" is water.

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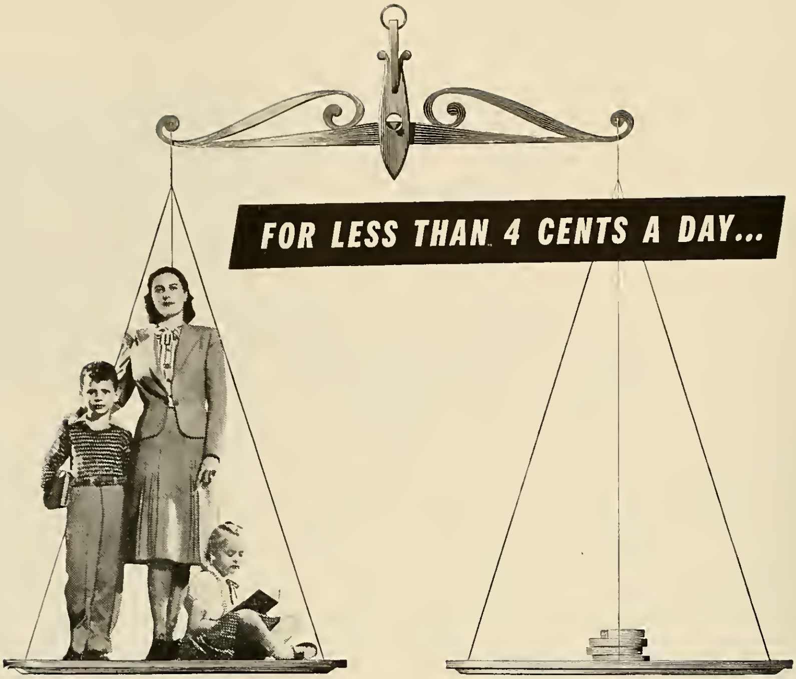
The American Museum is open to the public every day in the year without charge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Gardening	Ellen Eddy Shaw, Brooklyn Botanic Garden
Elephants *Goats* *Poultry on the Farm*	Arthur I. Gates, Ph.D., Teachers College, Columbia University; Ernest Horn, Ph.D., The State University of Iowa, and Celeste C. Peardon, M.A.
Production of Foods	O. E. Baker, Ph.D., University of Maryland
Shell Fishing	Wallace W. Atwood, Ph.D., President, Clark University
Snapping Turtle	E. Laurence Palmer, Ph.D., Cornell University
Sunfish	E. Laurence Palmer, Ph.D., Cornell University, and Evelyn M. Van Duzer
Thrushes and Relatives	T. Gilbert Pearson, Ph.D., President Emeritus, National Association of Audubon Societies
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CENTRAL AMERICA ● TROUT FISHING ● LOST AMERICANS

SCIENCE, LIBERTY AND PEACE

by Aldous Huxley

Harper & Bros., $1.00
86 pp.

IT has become by now pretty apparent to almost everyone that the world is in a bad way. There are many who don't think about it much one way or the other. Then there are those who, inspired by the progressive optimism of the nineteenth century, hopefully expect mankind, particularly the representatives of Western Civilization, to pull out of this temporary mess into an era of peace and prosperity transcending anything known in the past. Both these classes of citizens should read Mr. Huxley's brief and sharply focused exposition of what is wrong with the present trends in our society. They should read him, if only to realize that all is not rosy and that our whole civilization is in mortal danger of destruction by the very forces that have brought it into being.

Those individuals who are fully as pessimistic of current developments as Mr. Huxley should also read this little book whether their diagnosis and prognosis are the same or not, for he has many pungent and acute things to say about the state of our society.

Briefly, Mr. Huxley's thesis is that science, particularly its inventive and technological aspects, has served to increase the power of the oppressive forces in society until the people no longer have adequate means of physical resistance. Science has also placed in the hands of the few, overwhelming powers of persuasion and deception through the use of cheap printing, radio, etc. At the same time technology has served to develop mass production, which in turn has uprooted the people, crowded them into unpleasant industrial areas, rendered them insecure, and deprived them of important psychological values. Science also, says Mr. Huxley, has except for a few philosophers perverted man's view of nature and destroyed respect for the individual.

These are serious charges, some of which can, I believe, be controverted, at least as the effective causes of a situation that Mr. Huxley depicts with great clarity. His own solution is one of contraries. He would reorientate science to aid the decentralization of society into small co-operative groups engaged in subsistence activities and in producing for local markets. He would also uproot the disease of nationalism which now stands in the path of co-operation among the peoples of the world.

I liked this little book for its recognition that our society has reached a critical point in its development, its courage in attacking one of the sacrosanct institutions of our culture, and its exquisite clarity of exposition.

HARRY L. SHAPIRO.

PLANTS OF HAWAII NATIONAL PARK. Illustrative of Plants and Customs of the South Seas

by O. Degener

New York Botanical Garden,
Fordham P.O., New York, New York
312 pp., 45 illust.

THIS is a photo-lithoprint reproduction of Degener's earlier "Illustrated Guide to the More Common or Noteworthy Ferns and Flowering Plants of Hawaii National Park, with Descriptions of Ancient Hawaiian Customs and an Introduction to the Geological History of the Islands" (1930). Reasons for the reproduction are that many of the plants illustrated and discussed are widely distributed in the Pacific region, and that many of the ancient Hawaiian customs mentioned or discussed are identical with those of the present inhabitants of other Pacific Islands. Following a brief discussion of Hawaiian geology, the origin of the Hawaiian flora is reviewed, immediately succeeded by the consideration of individual plant species.

The work is not a dry, descriptive botanical manual, but rather a popular discussion of selected plants and plant problems. The data are arranged under the common names of plants, the technical names appearing in the text. Technical descriptions are lacking, for the excellent illustrations obviate the need of these. On the other hand, extensive essays are often included, covering the economic uses of individual species, native beliefs regarding them, methods of preparing plant parts for food or for other uses, when and how certain species were introduced (if an introduced species), the significance of certain native plant names, and other human interest data.

The author has brought together a great deal of information regarding plants, plant problems, and human relationships with plants. He has, moreover, succeeded in presenting these data in an eminently entertaining and readable manner. This reviewer does not hesitate to recommend Degener's volume to anyone who may be interested in Pacific plants and plant problems; after all, as the author claims, a high percentage of the species he discusses are of wide Pacific distribution, and thus the work applies to a vastly greater area than Hawaii.

E. D. MERRILL.

WATERS OF THE GOLDEN TROUT COUNTRY

by Charles McDermand

G. P. Putnam's Sons, $3.50, 162 pp.,
17 illust.

THIS is a most unusual little book. In the first place, it fills a very real need by supplying exact information about the trouts of California's High Sierra. Furthermore, the author writes extremely well, and has a rare gift for transmitting the sight and feeling of high mountain country and the excitement of its trout-filled lakes and streams. Very beautiful photographs add to the fascination of the book.

"A land of snow fed lakes and streams inhabited by unsophisticated trout; enough brush to shade the water; not enough to tangle a back cast; and where competition is nil." This is the length of mountain country south from Yosemite Park through the San Joaquin watershed, the Kings Canyon National Park, and Sequoia National Park. It can only be reached by riding and walking, and it is made accessible by the John Muir Trail.

Plants of Hawaii National Park

Illustrative of Plants and Customs of the South Seas

By Otto Degener

(Author of *Flora Hawaiiensis)*

Devoted primarily to Hawaii, this book draws attention to the South Sea Islands as a whole, their origin and flora, and the customs of their kindly natives. Profusely illustrated. $2.50, from author, New York Botanical Garden, Bronx Park, N. Y. City 58.

In the chain of lakes that form the timber line sources of rivers, there are Loch Levens and Eastern Brook Trout planted years ago, Rainbows, and the author's particular object, the vivid, gamey Golden Trout. The angler works his way around the icy lake shores, clutching his rod in one hand and clinging to rocks with the other. He looks at the "indescribably lonely panorama" of Lake Marie and Mount Hilgard from the 10,872-foot crest of Selden Pass. He sees huge golden trout wallowing in the shallows of Lake Wallace; takes husky brookies from an unnamed blue lakelet "glittering stark and cold" near the snow fields of Silver Pass. There is a morning when, rubbing the sleep from his eyes, he suddenly comes upon an unbelievable sight in Long Indian Lake . . . "the crystal waters swarmed with life. Fat and lazy tadpoles swam in the shallows fearlessly. Myriads of slowly creeping caddis larvae hauled their pebble cases over the submerged rocks. And finning in and out among the swarm were sleek, bulging trout. Incredulous, I beheld Golden and Eastern Brook trout actually turn away as chunky polliwogs waddled past their snouts."

Charles McDermand set himself the job of prospecting every lake and stream of the Sierra for trout. This, he decides happily at the end of his vacation, will take all the summers he will ever have.

An Outline Guide to the

ART OF THE SOUTH PACIFIC

By PAUL S. WINGERT

$2.00

"An extremely useful outline of the esthetic achievements of the people of the South Pacific, since it brings together not only the cultural milieu in which the art flourished but also a descriptive catalog of the arts themselves. . . . Should be indispensable both to the student of primitive art and to the student of Pacific cultures." — H. L. Shapiro, *American Museum of Natural History.*

"The descriptive and explanatory accounts of the art of the various islands and ethnic groups, presented in outline form, are clear and simple, and the plates are excellent."—John T. Frederick, *Chicago Sun.*

Columbia University Press

The last chapter of the wholly delightful book is devoted to routes and equipment, followed by several invaluable pages listing each lake, its locality, and its trout. The end papers are maps of the author's route.

F.LaM.

ALL THE BEST IN CENTRAL AMERICA

- - - - - - - - - by Sydney Clark

Dodd, Mead and Company, $3.00
288 pp., 18 illust.

THROUGH travel by air, the Central American Republics are now surprisingly accessible to the United States and will undoubtedly receive a flood of American tourists during these post-war years. In as short a period as several weeks, and with most of the comforts of home, one can now visit a number of the great Maya ruins of Yucatán and Guatemala and get at least a glimpse of a half dozen separate and quite individual Latin American countries.

For anyone planning such a trip, this book will be of real interest and value. Directed toward the vacation tourist, it is written in a light and chatty narrative style but, nevertheless, it contains a remarkable amount of very practical information on transportation, hotels, food, official regulations, the currencies of each country, and the clothes to wear. As a background for the traveler there is a good stock of generally reliable information on the archaeology and history of the Central American countries written entirely from the traveler's point of view.

Mr. Clark seems to be keenly aware of what the average American traveler is likely to want to see and do and has written a book that will be much used and appreciated.

Gordon F. Ekholm.

FIELD BOOK OF EASTERN BIRDS

- - - by Leon Augustus Hausman

G. P. Putnam's Sons, $3.75
659 pp., 466 illust.

IT is difficult for a professional ornithologist to give this volume a fair appraisal. The reason is that, to a greater extent than any other handbook of recent years, it assumes absolutely no prior knowledge on the part of the user. He may start with scarcely more discriminatory power than an ability to tell the birds from the flowers, and, by easy stages and time afield, may learn to recognize and name our whole rich bird fauna.

The introductory notes, and the 50 thoroughly illustrated pages of diagnosis by families, prepare the neophyte for the later steps of his analytical problem. Then come ten pages of eye-and-ear means of spotting birds commonly seen about the home grounds.

All of the foregoing parts of the book seem reasonable and logical, although they do not necessarily represent the process by which competent field ornithologists have mastered their art.

The remaining systematic section (pages 61-619) is for the most part admirable. There are simple keys to species by families, and accounts of each species headed by a black-and-white drawing. These figures, by Jacob Bates Abbott, are variable in quality but mostly adequate. In the case of certain birds which the illustrator may not know well in life (sooty shearwater, snowy owl, etc.) the pictures fail to convince. Six color plates by the same artist are attractive and practical, despite the random assortment of birds on some of them. Here and there the colors have gone wild in reproduction (e.g. parula warbler), and the attempt to distinguish between the gray cheeked and Bicknell's thrushes is specious.

The author's diagnostic notes and his quick descriptions of characteristics, voice, and normal environment are excellent. Welcome inclusions are his lists of regional vernacular names. The subspecies question is simply and intelligently handled.

A well-selected bibliography and an index close this useful book.

R.C.M.

THE LOST AMERICANS

- - - - - - - by Frank C. Hibben

Thomas Crowell Company, $2.50
196 pp.

WRITTEN for the lay reader, this little book deals with our earliest known Americans, when and by what route they came here, and what they did here after arrival. In a general way, the subjects of origin and antiquity have been under discussion almost since the days of Columbus. The first concrete evidence of geologic antiquity was published by Peter Kalm about 1750. Since then, and particularly since 1840, numerous alleged "proofs"—some fantastic and others doubtless genuine—have been recorded all the way from Canada to Patagonia, without, however, gaining full acceptance on the part of conservative investigators. This skeptical attitude is now fortunately changed. Since 1927, a number of well-authenticated associations of unique artifacts and extinct animal remains have been unearthed in both North and South America, until today there

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—Harry Hansen, *N. Y. World-Telegram*

Birds Across the Sky

By FLORENCE PAGE JAQUES

Illustrations by
FRANCIS LEE JAQUES

At all bookstores
$2.50

HARPER & BROTHERS
47 E. 33RD ST., NEW YORK 16

The enchanting story of Mr. and Mrs. Jaques' trip from the head-waters of the Mississippi to the Louisiana marshlands, when they followed the geese and ducks down their traditional autumn migration route, Mr. Jaques sketching the birds and their environs and Mrs. Jaques seeing new birds and identifying old ones.

"With distinction and delicacy of perception Mrs. Jaques conveys the moods of the many places they have visited, the seasons and the endlessly varying individualities of the birds. Her prose, alive and aware, has a poetic quality. She writes with humor and a note of deeper significance born of an increasing sense of the unity of all life and, in these troubled days, a support gained from 'the strength and radiance of nature.' "—*N. Y. Times Book Review*

"For its drawings as well as for its wit and good humor *Birds Across the Sky* will make friends the world over."
—*N. Y. Herald Tribune Book Review*

"She makes bird life a fascinating subject. The illustrations by Francis Lee Jaques, one of the finest wild life artists in the world, are gems."
—*Chicago Tribune*

remains only the difficult task of properly evaluating the facts at hand.

Dr. Hibben here narrates the more or less dramatic discovery details of about ten such North American sites (including three important ones of his own) ranging from Alaska, through Wyoming and Texas, to Southern California and dating, it is supposed, from Late Pleistocene times. He describes most of the artifacts recovered but figures only the unique Folsom, Yuma, and Sandia chipped-stone spearpoints. Fully two chapters are devoted to a rather suggestive presentation of the associated Pleistocene fauna, dwelling equally on its richness and its mysterious extinction.

Eminently readable, the book is neither exhaustive nor exacting, and therefore scarcely the proper subject for a really critical review, even if space allowed. The general reader may well complain of the illustrations. All are unlabeled. Two of them may lead some to think that early man was left-handed, and another may suggest that he was foolhardy enough to attack an unfettered mammoth with a mere javelin. The archaeologists may properly object to the repeated statement that early or primitive man was "dirty, cowering, and a cave-dweller" as not uniformly in agreement with the known facts; and yet, at the same time, the mammalogists will hardly credit his bravery with having materially affected the decimation of our Pleistocene fauna, even if he made ingenious use of fire in hunting. But, aside from these and other minor debatable points, the book is deserving of popular favor and will doubtless bring the author many a letter from would-be archaeologists.

N. C. Nelson.

REVISED LAPIDARY HANDBOOK

-------- by J. Harry Howard

J. Harry Howard, 504 Crescent Ave.,
Greenville, South Carolina
220 pages, 50 figs.

THIS book, designed as the author states "to provide practical instruction in all kinds of gem cutting for the beginner and the advanced amateur," does just that.

The handbook covers the cutting and polishing of both cabochon or smooth surfaced stones and faceted stones, usually transparent, cut with angular faces on the surface. Fascinating sidelines in the handling of gems are described—the making of beads, spheres, and jewelry, such as complete rings and bracelets of semi-precious stones. The manufacturing of mosaics is also taught, and the carving and engraving of stones. Mr. Howard has even included a chapter on diamond cutting, despite the fact that this profession is usually considered distinct from that of the lapidary.

Not only does the handbook teach in simple, easily understood language the use of lapidary equipment, but it also describes the processes for the home manufacturing of much of the machinery needed.

Mr. Howard has imbued the book with his own enthusiasm for the art, but, as an instructor, he has been careful to point out that the beginner cannot reasonably expect the same results in his first attempts as the advanced amateur or professional and that satisfactory methods for each individual must be determined to a large extent by "trial and error."

The text contains lists of books and magazines from which the amateur may learn more about the stones that he is cutting and also, indispensable to those who are interested but don't know how to begin, there are lists of supply houses where gem materials and lapidary equipment can be purchased.

As far as any craft can be taught by written instructions, this handbook serves admirably, and Mr. Howard's obvious delight and interest in his subject are extremely contagious.

Elizabeth Simpson.

Th

By
Harold McCracken

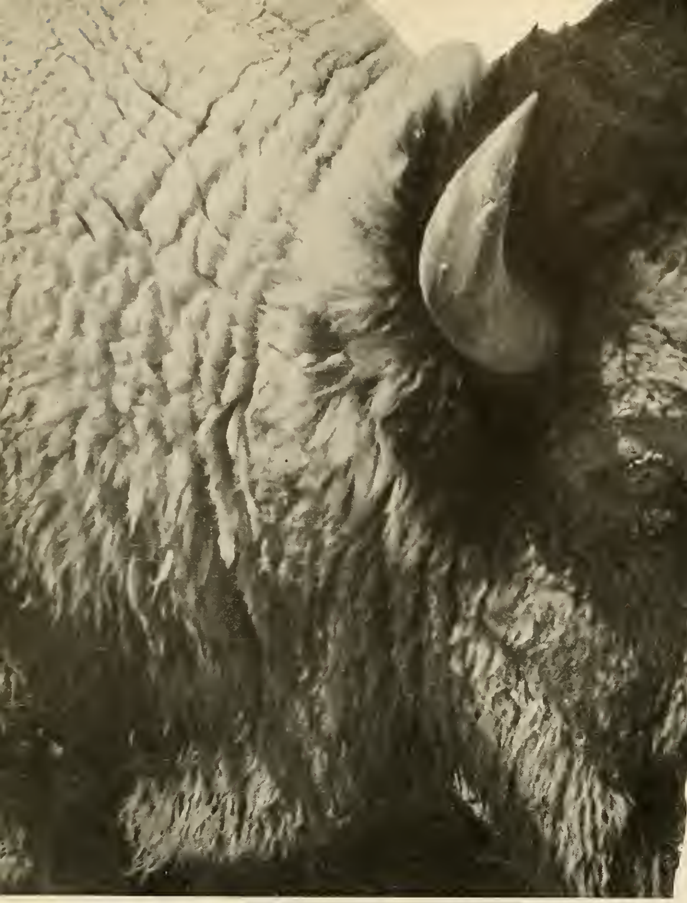


Photo by George E. Mushbach

"Big Medicine," the blond bull of Montana. He is all white except for a brown skullcap

THERE are today two white buffalo in the United States. This is two thousand times more than would be expected in the natural state, according to the accepted law of averages. The phenomenon is made even more unusual by the fact that the father of one of these animals is his own brother. Even aside from these exceptional circumstances, the story of the white buffalo is one of the most interesting pages in the most colorful chapter of the history of our Old West.

The buffalo is something of a national symbol of America. No other animal in our land is more imposing in appearance or more celebrated in adventurous lore. No one knows just how many buffaloes there were when the white man first came to America. Conservative estimates place the number at 30,000,000. Some say there were as many as 125,000,000—practically the present human population of the United States and possibly more large animals of a single species than have ever existed anywhere else on earth during the history of man.

And yet, our American buffalo is not a buffalo at all. He is really a *bison*, scientifically related to the European animal of the same name. A true buffalo is a creature *without* a hump on his shoulders, such as the African buffalo and similar varieties found in Asia. There are also other important differences, which the pedagogic purists make much about. But the white men who first explored our continent were not scientists. They named the pride of our plains a "buffalo"; buffalo he was called by the plainsmen and early settlers, buffalo he lived and died, so buffalo he no doubt shall always remain. Just as our "Indian" was misnamed by those first Europeans, who believed him to be a native of India rather than a resident of the New World of America, which they had unknowingly discovered. Nor were these the only scientific errors made by our forefathers. The animal they named a moose is really an elk; our elk is not an elk at all; our mountain goat is not a goat; and our antelope, sad to say, is not a member of the antelope family. The explanations are rather involved, and the layman is supposed to take the scientists' word for it without quibbling. But, from the earliest times, this has been a land of the free, and our ancestors had the prerogative of calling our native wild animals whatever they chose to call them.

Sacred WHITE BUFFALO

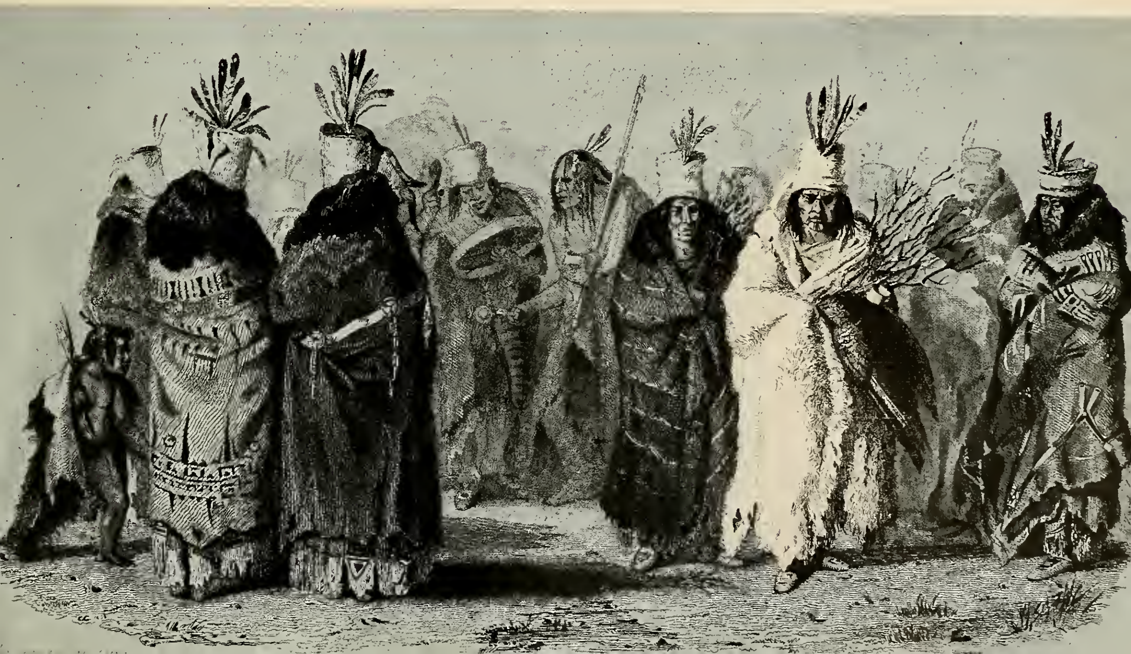
By the law of averages, we might have had to wait several centuries to see an albino buffalo. Now there are two in the United States—reminders of the days when millions of hoofs thundered across the plains and the Indians honored the spirit of the ghostly creature that was a special gift from the Great Spirit

So when the scientists raise their pedantic eyebrows and start explaining that our moose is not a moose and our buffalo is not a buffalo, we can just as blandly tell them to go jump in the lake—and a lake is really a lake in America.

In spite of the tremendous number of buffalo that once roamed America, these animals very quickly disappeared. It took Nature a million or more years to create the buffalo; but we Americans took care of that in a very short time. They were killed for food, for their hides, and for sheer sport. As early as 1849, a single season saw as many as 110,000 native-tanned buffalo hides shipped by river boat to St. Louis from the Upper Missouri Sub-Agency alone. A single hide sold for $3.00, but the total value of the shipment was more than five times the combined value of all other furs and miscellaneous trade. Thus began the greatest and most indiscriminate animal slaughter in history. It reached its climax during the years 1872, '73, and '74, when an average of about 5000 buffalo were killed every day of every week, with no time off for Sundays or Christmas. More than 5,000,000 were slaughtered during those three years. The buffalo melted away like snow in the glare of a midsummer's sun. Congress talked of interfering—but did nothing about it. By 1889 there were exactly 541 buffalo left in the entire United States.

The professional buffalo hunters were a hard-bitten breed of he-men and as such have never been excelled. That was a time when our West was a wild, wide-open land where neighbors who lived several hundred miles apart felt close enough to call one another by their first names. In order to have any real standing as a representative

THE SACRED SKIN of a white buffalo, worn here during a religious dance of the Mandan Indians, was venerated more than almost any other ceremonial property by various tribes of Plains Indians. (A drawing dated 1832-34, from the Maximilian Atlas)



citizen, a man had to have a record of killing at least a thousand buffalo a year—or its equivalent in Indians. Some of the better hunters, such as W. C. Carver and A. C. Meyers, killed as many as 5,500 buffaloes in one year. Some of the men hunted alone. Single-handed, Sam Carr regularly killed and skinned 35 to 40 in a day. That required a good man, even in those days.

When still something of a novice, a young fellow by the name of William Cody took a job as a hunter to provide meat for construction crews building the Kansas Pacific Railroad. He held down this job for eighteen months, through 1867 and '68, and during that time he personally killed 4,280 buffalo. This proved him to be a young man of promise. Later, when he knew more about this business of getting ahead in the frontier country, he won the first all-American championship sporting event, which carried with it the title of "Buffalo Bill" and a side bet of $500, by killing 69 buffalo in a competition supervised by judges and official rules. The challenger was William Comstock, who came off a poor second with only 46 buffalo killed during the eight-hour contest. The event was properly publicized and was witnessed by a large audience, who reached the scene by a special train from St. Louis, on which lunch and plenty of liquid refreshments were served. But neither of these contestants set a record. Charlie Roth, hunting on the Canadian River in 1873, single-handed shot 107 buffaloes in one "stand," and there are accounts of several other men who approached the hundred mark in one day's killing.

Buffalo hunting was far more of a business than a sport, although within the life-span of many Americans now living, buffalo shooting was advertised as the principal attraction of railroad excursions. The following example appeared in a Leavenworth newspaper:

> RAILWAY EXCURSION & BUFFALO HUNT—An excursion train will leave Leavenworth at 8:00 A.M. on Tuesday, October 27, 1868, and return on Friday. An ample time will be had for a grand Buffalo Hunt. Tickets of round trip from Leavenworth, $10.

Despite occasional sporting events of this sort, buffalo were slaughtered chiefly for their hides, each of which brought little more to the hunter than a poor skunk skin brings today. In 1870 the men who killed, skinned, dried, and transported buffalo hides across the Indian-infested plains to a place where they could sell them, got $2.00 each for the bulls and $1.75 for cows. Yet some men made as much as $10,000 in a year.

One white hide in 5,000,000

Among all the millions of buffalo hides that were taken during this bloody history, there was an average of only one white hide for about every 5,000,000 of the normal color. In all the great "southern herd," which was virtually exterminated during the 70's, only one white one is claimed to have been found. This animal fell to the gun of "Prairie Dog" Dave, who sold it to Robert Wright for the neat sum of $1,000.

George Bent, one of the foremost traders dealing extensively in buffalo hides, handled only five white buffalo robes in all his many years. He was born in the buffalo country in 1843. His mother was a Cheyenne woman, and his father was the famous Col. William Bent, builder of "Bent's Fort," the early trading post on the Arkansas River and a familiar rendezvous for such men as Fremont, Kit Carson, and many others who made history in the West. Few men had a better opportunity to observe buffalo hides than George Bent. Probably no other individual ever possessed a larger number of white buffalo robes. Nor were all of these "white" robes completely white. The first one Bent procured was from a five-year-old cow, killed by Crazy Mule, an Indian Medicine Man. Only the tips of the hairs were white. The second was of a three-year-old bull, killed by another Indian, Big Wolf, and it was the only pure white one of the lot. The third was the dark, cream-colored skin of a three-year-

Photo by Harold McCracken

Once there were over 30 million buffalo in America. By 1889, only 541 remained. About 5000 exist today. In the early 1870's as many as that were killed every day in the year

Photo by Harold McCracken

VISITORS to some of our National Parks and other preserves can still view the mighty animal that is a symbol of the unspoiled West

old cow; the fourth was dappled gray; and the fifth was the yellowish fawn-colored skin of a two-year-old bull.

A sacred symbol

The Indians placed an even higher value upon white buffalo hides than did the white man, for the Indians attributed to them great supernatural and sacred import.

One of the fundamentals of human nature is to cherish that which is rare or particularly unusual. Little wonder is it that the primitive Indian, with his strong penchant for the extraordinary, should hold the white buffalo in such high regard. The buffalo was the staff of life to most Indian tribes of the Plains. The skin, bones, hair, tendons, hoofs, and even brains supplied a large part of the necessities of their daily life. The animals were hunted almost continuously. Yet, there were but few Indian hunters who had ever looked upon a live white buffalo. The skins, when procured, were either offered as a tribal sacrifice or became a tribal fetish. In all instances they were looked upon with superstition, awe, and reverence; if necessary, they were protected with the lives of the entire band or tribe possessing them.

As one writer expressively but unthinkingly put it: "A white buffalo was so great a rarity that even the Great Spirit must have been surpised when one was born." The Great Spirit was not surprised, for, as every orthodox Indian knew, the Great Spirit personally had something to do with the birth of every white buffalo. That was why the Indians looked upon them with such veneration.

Some of the tribes believed that the white buffalo came from the far north—the traditional place where all buffalo originally emerged from an underworld beneath the shell of the earth.

Ceremony

The Cheyennes seldom used the skin of a white buffalo for any purpose, except as a religious sacrifice to the Sun or to Hiammawihio, the Great Power. Such a ceremony was witnessed in 1867 by George Bent. The famous trader happened into the Cheyenne camp just after a white buffalo had been killed and was privileged to see the whole ceremony.*

The man who killed the animal brought in the hide on his horse; then he rode into the center of the medicine ground or camp circle, where he dismounted and stood solemnly holding the horse. He brought in no meat, for the carcass of a white buffalo could not be eaten; it had to be left on the ground, otherwise no buffalo would ever again return to that place.

When the Indians saw what this hunter had brought in, they began to look through the camp for someone who was worthy of taking the hide from the horse with the prescribed ceremony. This could only be done by a man who had pulled an enemy off his horse in battle. Soon such a person was found. His name was Left Hand. He came up, stopped beside the horse, and told the people the story of the deed that qualified him to carry out the ceremony. While he spoke he

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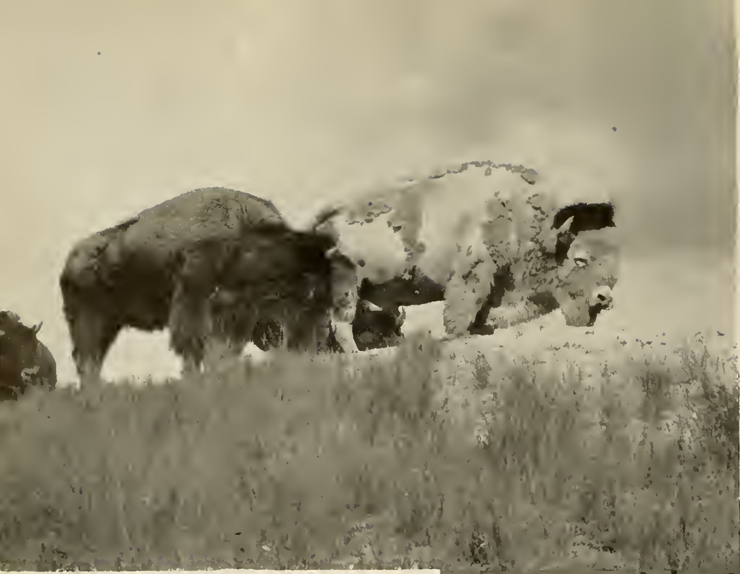
*The George Bent account which follows is taken principally from George Bird Grinnell's book, *The Cheyenne Indians,* (1923). Other sources of information on this subject are: Annual Report, Commissioner of Indian Affairs, 1850; *The Ox Tribe,* by George Vasey, 1851; *Buffalo Land,* by W. E. Webb, 1872; *Hunting Grounds of the Great West* and *Our Wild Indians,* by Col. R. I. Dodge, 1877 and 1882; *Sheridan's Troopers of the Border,* by De B. Randolph Kein, 1885; and *The Hunting of the Buffalo,* by E. Douglas Branch, 1929.



Photos by Harold McCracken

▲ "BIG MEDICINE" in the process of shedding. He is now thirteen years old

➤ THE FEW THOUSAND remaining buffalo may not produce another albino in our time. A view on the National Bison Range, Montana

pointed with a stick toward the locality where he had accomplished his feat. He told the story with typical Indian oratory: he had seen a Ute warrior riding in his direction and, hiding behind a tree, had waited until the enemy was close; then he had rushed out, pulled the Ute from his horse, and killed him with a knife.

When he had finished his story, Left Hand struck the white buffalo hide with the stick, took the skin off the horse, and placed it on the ground, where it remained for the rest of the day.

While a pole was being set in the ground near-by, a large sweat-house was built.

The next day the hair side of the white buffalo skin was ceremoniously painted with blue paint by an old man whose naked body was painted gray from head to foot. He prayed while he worked.

When the hide was painted, women came in crowds, bringing their children and various offerings of calico, beads, moccasins, and other gifts which were to be tied to the sacrificial pole as offerings to the Sun. As each child was brought up, the old man passed his hands over the child's head, arms, and sides, praying for its long life and health and for an abundance of the things an Indian cherishes most.

All during this time, many old men went into the sweat-house to sweat and pray. When they came out, they gathered around the naked master of ceremonies while the white buffalo hide was folded and tied to the pole. This was done with great pomp and dignified procedure, and with fervent final prayers.

Among those tribes who preserved the hides of white buffalo as sacred harbingers of power and "good medicine," meticulous care and scrupulous ceremony accompanied every phase of the procedure.

In most instances, when a tribesman shot a white buffalo, he did not dare to touch it. First he had to find someone who was spiritually qualified to do so. If the animal had been killed with an arrow, the man who performed the first part of the ceremony had to be a warrior who had killed an enemy with an arrow. If the buffalo had been shot with a gun, the man must have killed an enemy with a gun.

When the proper individual was found, as many persons as possible were gathered to witness the ceremony. Respectfully, the white buffalo was propped up on its knees and belly in such a manner that its face was to the East. The man who had killed it then ceremoniously pulled tufts of hair from the right shoulder, right rump, left rump, left shoulder, and withers, dropping each bit of hair on the ground as he did so. With each bit of hair, a prayer was offered.

After this, with much ceremony, the animal was turned on its back. It was disemboweled before the skinning began. The man who skinned the head had to be a warrior who had counted coup upon an enemy and taken his scalp. (To "count coup" means to have rushed in and merely touched a wounded enemy with a stick or anything held in the hand, without inflicting a wound. This was considered an act of the highest bravery.)

When the skin was completely removed, it could be loaded on a horse only by a warrior who had either taken a captive in battle and carried him off on horseback, or by one who had rescued a dismounted fellow tribesman in like manner.

To the man who had killed the white buffalo went the honor of leading the horse that bore the hide into camp.

When the procession reached camp, the hide had to be unloaded by someone who had pulled an enemy off his horse; and the man who carried it into the owner's lodge had to have broken into an enemy's lodge.

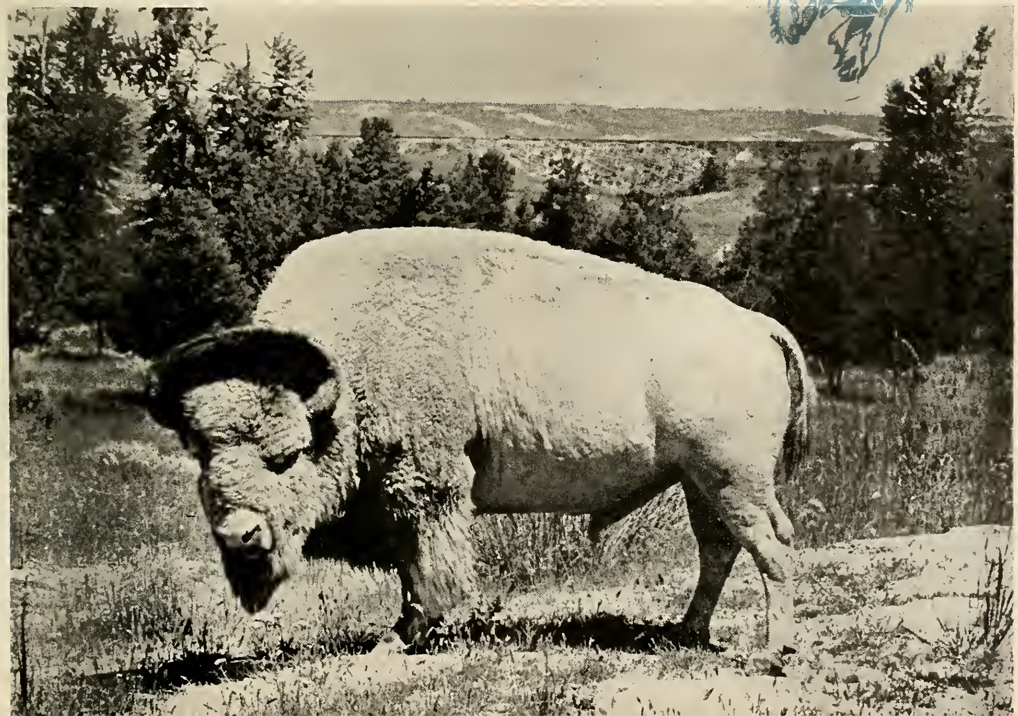
All the warriors who had counted coup on more than one enemy were invited into the lodge. When they were seated around the white buffalo skin, the woman who was to tan and decorate it came in. She sat down beside the skin, dropped her dress to the waist, and permitted the master of ceremonies to paint the exposed part of her body with a white paint made of clay. He wiped away a circle on her chest, to represent the Sun; and on her back at the right shoulder he wiped away the paint in the shape of a crescent. With his finger nails he scraped stripes over her body from neck to waist. He also hung small bundles of white sage at her waist in front, over each hip, and behind each ear.

Among different tribes the method of painting varied; but no Indian woman would even dare to touch the skin of a white buffalo before she was properly painted and prayed over by a medicine man or warrior who had the specific power to absolve her from the serious consequences of the taboo. Even the knife she used had to be blessed and purified for the task. The woman held the blade rigidly upright while the master of ceremonies related the story of a coup he had performed. At the end of the story the woman cut a single hole in the edge of the hide for staking

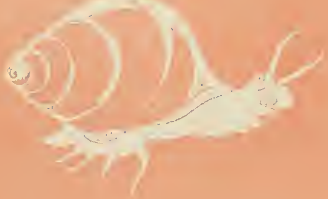
Continued on page 341

"Big Medicine" lives on the National Bison Range on the Flathead Indian Reservation. A century ago wars might have been fought over his hide; today he is a very rare scientific curiosity

Photo by George E. Mushboch



"Cat's-eyes" EXPLAINED



When is a cat's-eye not a cat's-eye? A description of highly-prized souvenirs from the Pacific coral islands

By William K. Gregory

Curator Emeritus of Fishes and Comparative Anatomy, American Museum of Natural History

AMONG the curious natural history souvenirs brought home from Pacific coral islands by members of our armed forces, few are as highly prized as "cat's-eyes." This is especially so when they are mounted in rings, necklaces, bracelets, and clasp pins. Small ones are about as large as half a pea, large ones the size of dimes or even quarters. They are nearly flat on the bottom, convex on top. They have a gleaming "eye," often with a greenish central area surrounded by circular zones of pearly white, ivory, and dark brown; but their colors vary, some having dark blue centers, while others have red or yellow.

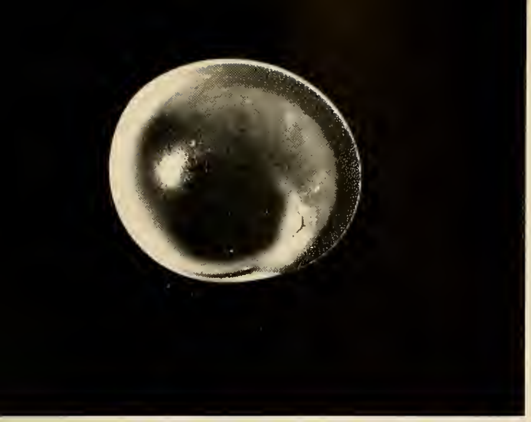
Sergeant H. O. Collier, III, U. S. Marines, while in service on several Pacific coral islands, specialized in collecting, preparing, and mounting cat's-eyes. In a thrilling article on his collecting experiences, in *Rocks and Minerals*, August, 1944, he states that: "The very finest stones are of a deep color all over, though there are many intermediate shadings which when properly polished and matched will find no peer in the realms of gems. One matched necklace, which the writer is making from seven pure white cat-eyes, will, he believes, have an almost unearthly beautiful and pearly sheen when finished—he can think of no more beautiful necklace to go with a blue evening gown."

The present writer's interest in cat's-eyes began early in 1939, when he first picked up one of them on the beach at Heron Island in the Great Barrier Reef, off the coast of Queensland, Australia. Pretty soon the diving member of the party brought in another from the coral reef, and finally one was found in its natural position inside the coiled tube of a turban shell (*Turbo petholatus*). The cat's-eye is the operculum or trap door of the shell, which fits snugly into the trumpet-like tube and protects its owner, the living sea snail, from intruders.

The year before, on the beach near Cape Town, South Africa, we had bought from a Greek fisherman three large turban shells of an allied species (*Turbo sarmaticus*). In the biggest one the trap door was as large as a fifty-cent piece. These opercula had no "eyes." Instead, the convex side was composed of innumerable stony papillae, or warts, springing from a rounded lump of the same material. The flat side of this trap door was firmly attached to the upper surface of the rear part of the snail's muscular foot.

When the turban snail is crawling, the whole shell rides on the foot. If the animal is touched, it quickly pulls itself into its shell by means of bandlike muscles which are wound around the columella or axial core of the shell. First the snail pulls its head in, and the delicate eye-spots and tentacles disappear. The last part to be withdrawn is the rear end of the foot bearing the trap door. The trap door rolls over with the foot itself and closes the opening of the shell as it swings into place.

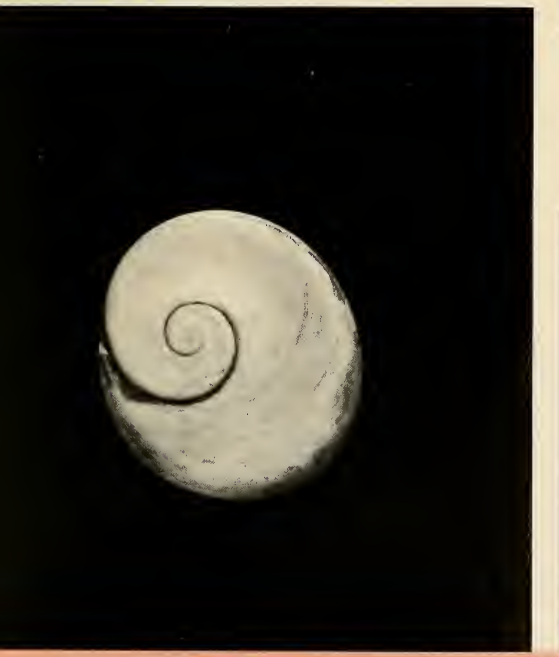
In his wonderful book on Growth and Form, D'Arcy Thompson has explained how it is that the operculum of sea snails always fits exactly the opening of the coiled shell. Broadly speaking, it is because the shelly tube and its lid are both secreted by the same organism. The rate at which the tube itself grows is thus harmonized with that of the disc that fits into the tube. But, we may ask, how is it that the "cat's-eye" is nearly circular whereas the opercula of other species of turban shells are more oval? The shell itself is, so to speak, merely the outer skin of a wormlike animal. This covering grows so much faster on the outer side that it pivots on the inner side and forms a spiral coil or helicoid of regularly increasing diameter. Even when the snail comes out of its shell, its large screw-shaped "liver" or digestive gland is wound around the screw-like columella or central axis. If the shell-secreting mantle grows more rapidly on the outer side, that side of the shell will bulge outward and the aperture will tend to become elliptical. If the inner side of the mantle keeps up with the outer side, the aperture itself will be more circular and less elliptical in its outline, and so will the operculum.

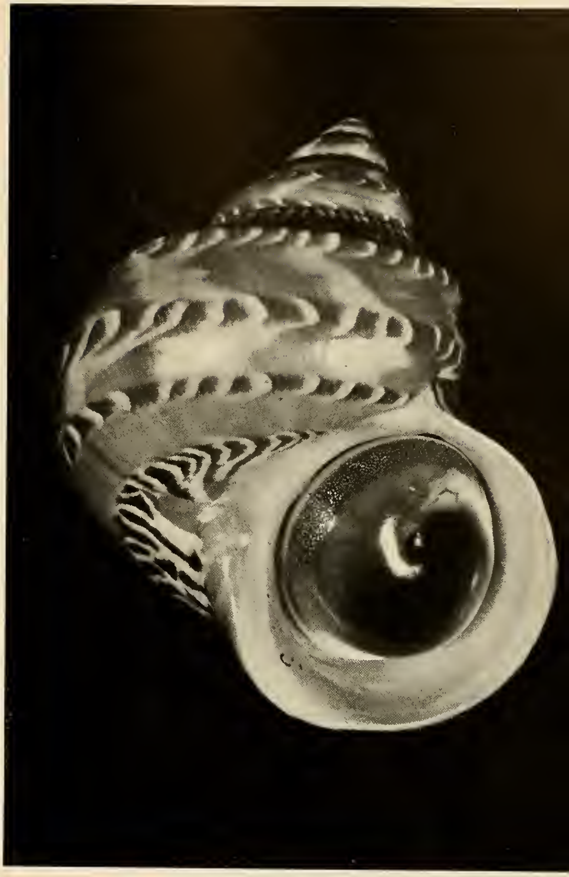


▲ THIS GLEAMING CAT'S-EYE is not a gem at all, but the operculum or trap door of a sea snail

➤ A CAT'S-EYE in the coiled tube of a turban shell (*Turbo petholatus*) from the Philippines. The operculum fits snugly in the tube and protects the snail from intruders

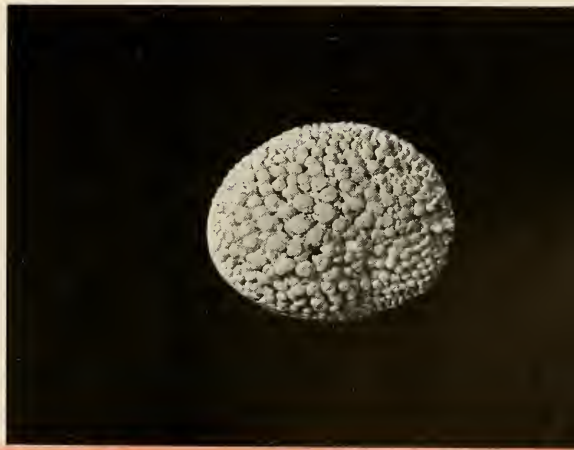
▼ THE OTHER SIDE of the cat's-eye. Its spiral pattern is a record of the cat's-eye's spiral development

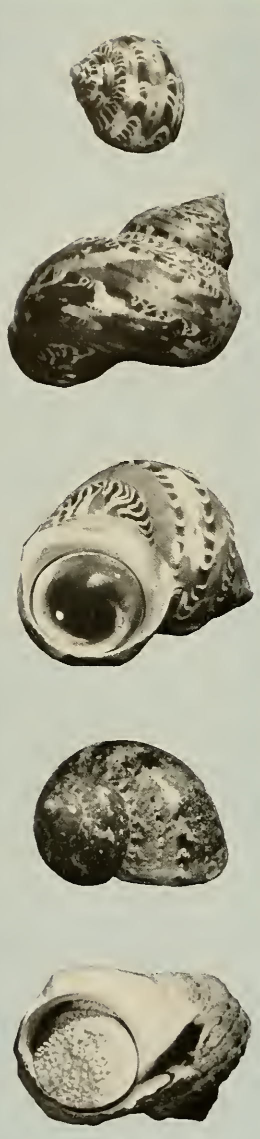




A.M.N.H. photos

▼ THE OPERCULUM of a South African turban shell (*Turb sarmaticus*). It lacks the eyelike spot and banded colors of th cat's-eye and is not smooth but covered with stony warts or papilla





Unlike the curved, outer surface of the cat's-eye, the inner surface is flat and is covered with brown horny material which bears a spiral design. As Sergeant Collier notes, "Each cat-eye is different from all others. And yet, as individuals, they all have a certain internal corkscrew-like pattern that once learned can be used in their cutting." This spiral pattern is a record of the cat's-eye's spiral development. The original center of growth can be seen well to one side of the actual center of the mature disc.

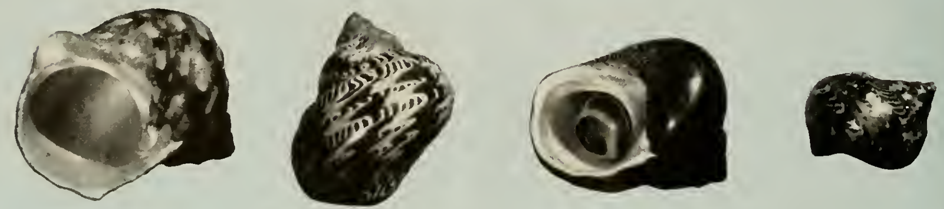
The essentially helicoid or screwlike origin of the cat's-eye pattern is indicated in the opercula of a small species of turban shell which I collected along the shores of Mayor Island, New Zealand. These shells are thin and their opercula are flat, possibly because there may be less lime along the shores of this island of volcanic glass (obsidian). On their outside surface these oval opercula each bear two parallel-curved, rounded ridges, which suggest portions of the concentric color bands of the cat's-eye.

The color bands of the cat's-eye have their origin in the deeper levels near the inner surface, on which the spiral design can be seen. Possibly some of the pigment cells of this inner surface have had their brown, red, yellow, or blue secretion squeezed out by the pressure of the hardening stony layers. Perhaps the coloring matter has been aided in spreading by the traces of water which were noted by Sergeant Collier within the stony substance of the operculum.

How does the cat's-eye get its glassy surface? The basal layers of the operculum are secreted by the back of the "foot," but the surface layers may be laid down by the adjacent margins of the shell-building mantle, which form the correspondingly "glassy" inner and outer "lips" of the aperture. Perhaps the pigment cells of these mantle-derived layers also are responsible for the color bands, which, after all, are parallel to the subcircular rim of the entire aperture.

Does the cat's-eye help to protect its snail by resembling a real eye? Sergeant Collier's account indicates that when the snail is crawling, the cat's-eye is a conspicuous object, as it also is when the snail is withdrawn into the shell. Perhaps the "cat's-eye" is really misnamed, for it strikingly suggests the round, glassy eye of a large octopus. In the dim holes in the coral reef, where snails and octopuses live, such a "Keep-off" signal might well scare away the alert, nibbling fishes of the coral reef, which are always on the prowl for tender snails and bivalves. If so, most turban shells and their allies lack this added protection. Many of them have oval or subcircular opercula, with a stony base and a round glassy surface, but only the "cat's-eye" turban, so far as is known, has taken the final step of developing a central dark spot surrounded by more or less spiral light and dark zones.

THE CAT'S-EYE SNAIL and some of its relatives



By James P. Chapin
Associate Curator of Birds,
The American Museum of Natural History

Wideawake Fair INVADED

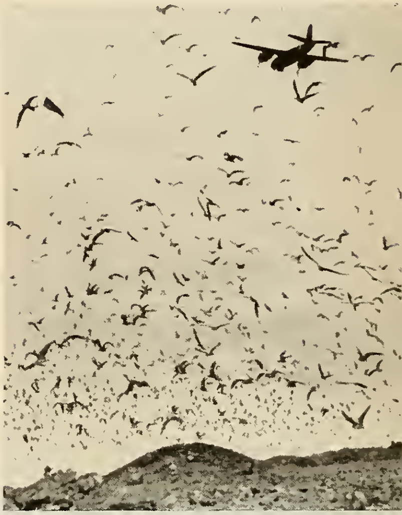
Another "Birds vs. Airplanes" episode tells the adventures of an ornithologist in making the airfield on Ascension Island safe for planes with a minimum of destruction to the bird life of the island

IN the spring and summer of 1942 our bombers began flying from Brazil to Egypt and India. Even to the enemy it must have been clear that we would try to use a stepping-stone in the South Atlantic, but no American in military service dared whisper the name of Ascension Island to a civilian. Nearly eight degrees south of the Equator and in the same longitude as the western extremity of Africa, Ascension would provide a strategic landing field for planes that did not have quite enough cruising range to fly non-stop from South America to Africa. Though not quite in the direct line, the island is 1,448 miles from Brazil, and 1,362 miles from Accra, our base on the Gold Coast.

To me—a civilian and ornithologist with graying hair—no one had revealed in March of 1942 that an American Engineer Regiment was landing at Ascension Island to construct an airport with a broad runway over a mile long. This barren and hilly volcanic island offered little level ground. It is roughly triangular, about 8.7 miles long by 7.2 miles wide; and except for Green Mountain, an eminence rising to 2,817 feet, is mainly composed of bare cinder cones, craters, and lava fields. Only on its highest mountain, which is often bathed in cloud, has it been possible to plant many bushes and trees, establish green pastures for cows, and cultivate green vegetables.

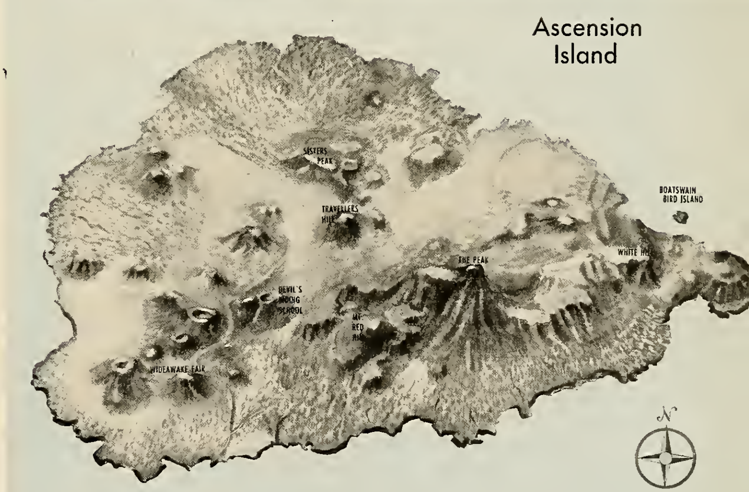
On the southwest side of the island, however, there are a few plains and wide valleys. There, with modern machinery and explosives, it proved possible to complete the needed runway in less than three months. One volcanic hillock, to be sure, was a serious obstacle and required mining with tons of blasting gelatin. On one occasion eleven tons of explosive were set off. Once the runway was in operation, the herculean nature of the task could scarcely be imagined.

Finally the airport was ready, and on July 10th the first Liberator bomber landed on it. Very soon an Air Force squadron with its little Aircobras took over. At the beginning of their work, the engineers had noticed a few fair-sized birds, sooty terns or "wideawakes" as they were called locally, flapping about; but these soon disappeared. The frigate-birds, boobies, tropic-birds, and noddies that frequent the rocky coast of Ascension scarcely showed themselves near the air base. The weather was warm and mild, the breeze blew always from the southeast, and thunderstorms



➤ **Accra-bound,** a bomber climbs above the shrieking mass of birds that took to the air as soon as the roar of the engine was heard

All photographs by the author
Drawing by Museum Illustrators' Corps



▲ SURF BREAKS on the rough lava shore of a bay on the south side of Ascension. Much of the coast is like this, and what sand there is in the bays contains practically no silica

▲ BIRD ISOLATIONISTS. They make their homes on distant islands, yet even they suffered many thousands of casualties during World War II

were almost unheard of. The seasons could not be distinguished.

If the new base had not been named "Wideawake Field," one might have supposed that no one recalled the fame of the "Wideawake Fair," marked on navigation charts in this quarter of the island. Well known before 1870, it was a huge nesting colony of sooty terns, often said to number millions. Here the birds assembled not annually in the strict sense, but about every nine months, year in and year out. The terns' eggs became in season a valued addition to the diet of men of the British naval station, and later of employees of the Cable Company. They were said to be especially good when hard-boiled. For six months the birds would swarm about their "Fair"; then they would disappear for three months.

During July the Air Force began its practice flights, preparing to defend the base from attack by sea or by air. Soon it became evident that the new runway extended right down into the valley that the wideawakes preferred above all other parts of the island, because before the end of the month the reinvasion by the birds began.

At first their flocks assembled mainly toward sunset and settled down on the very ground where the majority had probably been hatched. They did not care for the hard black surface of the runway, but there were still several acres of sandy soil and low lava rock around its far end. These they cherished as only returning sea-birds, with their marvelous "bump of location," can love an age-old nursery.

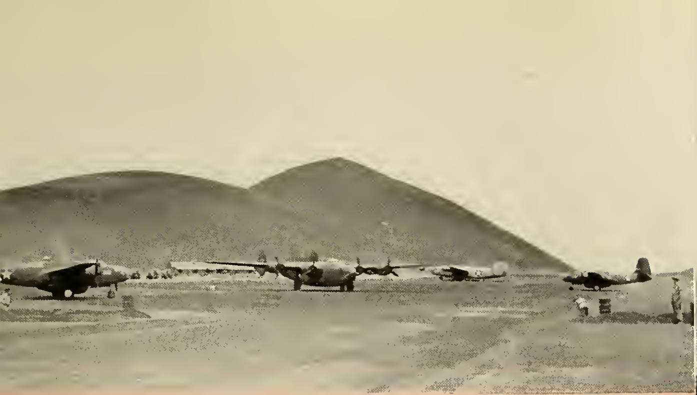
Then if a plane started to take off, the roar of its engine from afar sent a mass of thousands of birds up into the air, to hover directly in the path of the plane. They were not large birds (none weighed over eight ounces), but they were an unalloyed nuisance. Hundreds were killed as planes left the field. There was real worry lest they break windshields, clog air-scoops, or get into open spaces in the engines. As the birds gathered in ever-increasing numbers, the airplane traffic also grew, and the attendant dangers multiplied. The little pursuit planes could generally climb above the cloud of terns; but two-motored bombers, now being ferried in quantity, had a slower rate of climb.

Shooting the birds made no difference; the survivors had no fear of their dead comrades. Firing airplane cannons and .50-calibre machine guns over the field troubled them little; smoke candles had only a brief influence. The Engineers laid strings of half-pound packets of nitro-starch over the ground and exploded them every two hours from nightfall until eleven o'clock. At first this kept the birds in the air for about ten minutes. After four weeks it was noted that they settled down again after *five* minutes! Toward August 25th they had the audacity to start laying eggs right under the nose of our Air Force.

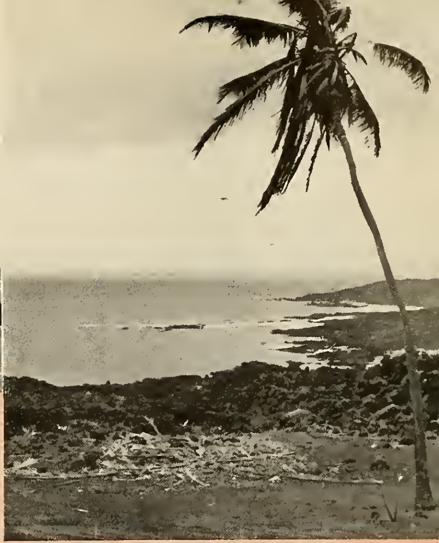
No wonder the officers at Wideawake Field complained to Washington. It was suggested then that some bird student might contrive a solution. At that very time I was seeking a means of transportation to the Congo after a personal invitation by the Belgian Minister of Colonies. Steamers were few, and enemy submarines very active in the narrow sea between South America and Africa. Now I learned that I might earn a passage by plane if I could find some way to chase those sea-birds off the secret runway on that mysterious island—a "Shangri-La" without seasons, lying west of the Gulf of Guinea.

I knew little more about this particular Wideawake Fair than what I had read 30 years before in the Cambridge Natural History and more recently in books by David Bannerman and my colleague Robert Cushman Murphy. But I had known the terns on various islets scattered from the Dry Tortugas off Florida to Easter Island in the South Pacific. If they could help me fly to Africa, I should be glad to try to dislodge them.

After dark on September 4th I climbed into a Stratoliner at Natal along with the military passengers for Africa. These huge four-motored transport planes had extra tanks for fuel, and often crossed



▲ **The broad airstrip** at Ascension where American bombers made brief stop-overs on their way to Egypt, shortly before we invaded North Africa



➚ **This coconut palm**, overlooking Southwest Bay, is the only tree growing anywhere on the shores of Ascension. It was already famous in 1877 and is marked on all navigation charts

without touching at Ascension. The tanks left less space for passengers. The quiet efficiency of the crew under Captain Fredericks impressed me most of all, and I enjoyed watching the navigator shoot the stars from his perch under a plastic dome. As day began to break we were at 7000 feet, above a solid blanket of grayish-white cloud. It seemed breath-taking to be heading into an orange sunrise with our objective so completely obscured. Was the navigator's aim so perfect? But then I realized that he was only one of the expert team. The radio-man was now getting signals that kept us on a beam.

Soon we were down to 5000 feet, then we dived through the cloud to 1,200, where the ocean at last became visible. The sun had risen and was trying to shine through a shower directly ahead. If there was an island, it was hidden behind a glowing mist. Before long a corner of our objective, with one bare red hill, broke into view. Visibility was so limited that we came in crosswise over the runway and circled before landing. Later the ground force pretended we had deserved to be fired on, but I feel sure they knew the ship that kept them in touch with home.

After breakfast Colonel Ronin, Commanding Officer of Wideawake, and his Executive Officer, Major Norwood, took me down to see the terns at arm's length. The Major's dog, Agnes, enjoyed rushing at a few of the birds but seemed awed by their vast numbers. The Stratoliner refueled and took off for Accra without me and roused the birds to furious excitement. The Admiralty Chart had long indicated several different spots as "Fairs" frequented by great numbers of terns. Here I found myself in the midst of the one that had been most important in recent years. The air seemed filled with tens of thousands of squawking birds, gracefully buoyant, yet the ground was likewise covered with other birds sitting dutifully on their eggs. Many refused to take wing, opening their beaks and pecking at us as we drew near. Had I been told there were 100,000 birds right here, I might not have questioned the figure. Colonel Tomlinson, who is still the British Government's Representative there, tells me that he cannot decide whether there are two million or only one million of them, all told, on the southwest portion of Ascension.

By early September in 1942 most pairs had their nest, a bare spot on the ground, with one egg. Only about one nest in 70 has two eggs, and a second laying is not the rule if the first succeeds. This gives an indication of the relative safety of life on the warm oceans and on small islands in them, provided man does not upset the balance. We found that the usual distance between eggs was 1.5 to 3 feet in populous spots, or that each nesting pair occupied from 6.5 to 7 square feet. After pacing off the area close to the end of the air strip I concluded that 70,000 birds would be a conservative estimate. Many would, of course, be off fishing. There were other busy colonies not far away, some visible on the lava farther off to the northeast, and many more hidden behind the adjacent hills.

Dead birds littered the ground in all directions, and wounded birds wandered about, soon to die of starvation. The Army had promised to respect the fauna and flora of Ascension. Yet our aviators hated these pesky birds, and with excellent reason. What was to be done?

I find it hard to hate birds, no matter how annoying they may be. They can scold me roundly or even peck at my hat or head. All my training has been for their protection. An ornithologist is expected to preserve, attract, and encourage birds. In this situation men's lives were at stake in war; anything was evil that interfered with our bomb-

▲ Boatswain bird islet, only 220 yards from Ascension, is a metropolis of frigate-birds, masked boobies, two species of tropic birds, lesser noddies, and white terns

▲ Captain Richardson beside a lava boulder so hard that it rings like iron on the outside, yet filled with soft trachyte that has weathered away to powder

ers on their way to Egypt and the Orient.

Hasty action was useless. The engineers had proved that. I decided to take a few days for watching and experimenting. I would invite suggestions and try to save the birds' lives while moving them out of harm's way. What would do this? Certainly not killing. "Paint all the rocks bright red," was a suggestion of doubtful value. Had the whole area been paved like the runway, it would not have been suitable for nesting—but this was impossible. Had it been covered with chicken-wire, raised a foot or two above the ground, the terns could not have settled there—but there was not enough netting to be spared from use for camouflage. We did lay out three rolls of netting over low rocks where there were nests in the hollows. With characteristic perseverance the terns struggled to get down through it, and numbers of birds became hopelessly entangled.

As I have remarked, fresh wideawake eggs, with yolks almost scarlet in color, had been gathered for food by the islanders for a century or more. They are just as tasty as hen's eggs. Egging was believed to do no great harm, for the female tern was said soon to lay another egg near by. But would she come back to the place where she had been robbed?

I measured off two rectangles, each containing 1,100 square feet, and cleared them of eggs: 161 in one case, 167 in the other. The next day only six or eight birds were resting on each area, and during the next few days only a half-dozen eggs were laid on each. These were removed, and the rectangles became birdless spaces surrounded by occupied nests on all sides. By now the first layings were completed, and the birds that had lost their eggs all moved away.

This was just what I had hoped, both for military reasons and those of conservation. The life of an adult bird was far more valuable than any egg. Within a few weeks another egg would doubtless be deposited somewhere, and the same bird might go on living and breeding for fifteen years or more. And we'd be very happy to have it breed so long as it stayed away from our airport.

My studies had gone on for six days, and I was in frequent consultation with Major Clyde H. Brown. However, the Army was impatient, for the eggs were mostly well past the edible stage. No sooner had I related the success of my simple experiment than the decision I was so reluctant to take was snatched from my control. The Army wanted an omelet, and as the French say, "You can't make an omelet without breaking eggs."

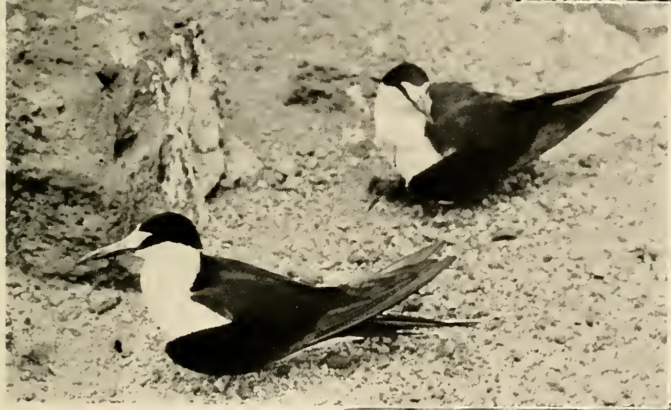
On September 12th Major Brown took a detail of three soldiers, each with a long stick, and the breaking began. Every egg in the offending area was to be destroyed, but no adult tern must be struck. We felt sure they would leave within a few days. That first morning's effort accounted for 10,000 eggs, though only one-fifth of the area was covered. By nightfall it was estimated that 35,000 or 40,000 eggs had been destroyed. Two days later another 5000, at least, were broken on an adjacent area.

What an omelet! But it would be eaten only by larvae of carrion flies and the troublesome dermestid beetles that swarm over this section of the island. The unfortunate wideawakes were highly excited, and from time to time the majority would rise noisily in a body from the devastated area.

After a couple of days, relatively few of the terns remained on the ground save those with a fresh-laid egg or one that had been overlooked. Those hovering above the end of the runway seemed scarcely one-fourth of the earlier number.

▲ An American supply ship lies at anchor off Georgetown, the sleepy little port of Ascension. Normally Georgetown is merely a crossroads of the ocean cables, occupied by a station of Cable and Wireless, Ltd.

▲ Author meets tern. The upraised wings are not a gesture of politeness, but rather of indignation



◄ The tern eggs have begun to hatch. The newly hatched chick (*lower lefthand corner*), speckled with light and dark gray, readily escapes notice on the ground

▼ Two chicks (*scarcely discernible at lower right*) are doubtless the cause of this quarrel. "Why don't you keep *your* baby at home?"

Small parties continued to fly across the runway, going to and from colonies a little farther back from the ocean. During the evening flocks of birds would still settle on the ground where their nests had been. This was annoying, even though night departures of planes had never been attempted. But the birds were very nervous, and soon they decreased to one-fifth of the earlier number.

Gradually the numbers flying over the devastated area dwindled. I visited several other thriving colonies of wideawakes at various points well away from the runway and made sure they were unmolested except by the feral house cats which have long been known to prey on the nesting terns. Even on September 22nd I could find no chicks that had hatched. Yet on that day a frigate-bird was shot as it passed not far from the camp, and in its crop and stomach I found five newly hatched wideawake chicks. Somewhere on the island the new brood had begun to appear.

Eleven days after the first wholesale destruction of eggs I noticed few birds flying over the abandoned area even after sundown, and none alighting. On September 23rd I watched from the control tower as a great Stratoliner took off, and was gratified to see no flock of terns ahead or even beneath it. I had made my written report, had warned of the expected return of the wideawakes at their next season, and suggested measures to discourage them. I recommended that if eggs had to be destroyed they might best be gathered while fresh, so they could be used in the mess. There was nothing more I could do for the Air Force.

My cabled application to Washington for an air-priority, however, brought no reply. I seemed to be a forgotten man. Thus I continued studying the terns, and on September 27th I began to find chicks in other nesting colonies which we had been careful not to disturb. Most of the eggs in any given colony seem to be laid within a period of a few days; but in different colonies on the island, nesting may vary by three weeks or more. I regretted having arrived after all courtship had virtually ended, and I was not sorry that my departure was being delayed a week or two.

At times, it is said, exceptionally heavy rains will wash out a whole colony, and laying then begins anew on a large scale. In view of the birds' normal six-month stay on the island, such a delay does not seem necessarily to alter the nine-month cylic return. I often wondered where our refugees went after leaving the end of the runway, but this I never learned. It was hoped they had founded a new breeding community elsewhere. I could not see that they joined any of the other groups under observation, and I felt sure that a week or two at least would be needed for the development of a new egg.

Among the civilian employees of Cable and Wireless, Ltd., Mr. Thomas Dodge had quickly become my best adviser on island affairs. He was Harbor Master and Superintendent of the Farm on Green Mountain. Major Norwood drove me up the mountain, and Colonel Ross Baldwin, C.O. of the American Forces on Ascension, took me by launch around the north shore to see Boatswain Bird Islet, a great white rock where vast numbers of other sea-birds nest, including frigate-birds, masked boobies, tropic-birds, noddies, and white terns.

I found ample time to study other peculiarities of the wideawakes. Exact recognition of their nest was highly developed; otherwise they could never succeed in hatching chicks. Move an egg as little as eight inches, and the returning bird would probably not recognize it. Yet simple experiments proved that landmarks, such as neighboring stones, were utilized. If the stone were moved, the bird might not recognize its egg until it was replaced in recognizable relation to the altered landmark.

The exact coloration of the egg was unimportant. If you added a second egg, the tern would usually incubate both. A third egg, however, made evident difficulties in placing the feet, and would soon be pushed away. A large photoflash bulb with gleaming surface would not be accepted in place of an egg, but a small one might be incubated for a few minutes. There was no reliable way of telling the sexes apart, and some birds were coming back to the nests at all times of day. Dissections of several birds killed during one afternoon indicated that the majority then incubating were females, while three specimens taken from nests at 11 P.M. were all males. This is not sufficient proof that one sex always spends the night on the nest, for it has been stated that incubating birds are relieved only every 24 hours. It surprised me, too, that I never saw a wideawake bring in a fish either for mate or for young, and, stranger still, all the birds I dissected had empty stomachs.

When the eggs started hatching in the ravines southeast of the runway, scores of chicks could be seen the first day. One parent stayed near the chick; the other may have been off fishing, but during the few remaining days of my stay I never saw anything fed to the downy young. If the young were fed at all during these first few days, it must have been done toward evening. By day the chicks moved about, sometimes crouching in some angle in a rock. It was plain that the parent bird recognized its own offspring, and the

▼ MALE AND FEMALE seemed to share equally the duty of incubating the speckled egg. Both develop two patches of bare skin amid the feathers on the lower breast

chicks did differ by the lighter or darker tones of their speckled dress.

A chick straying into some other territory was more than likely to be attacked, and this brought on duels between adults. But the old bird could call its own chick with a low vocal note, and the chick quickly came to snuggle beneath the parental breast. We found more than one chick dead, with wounds on the head undoubtedly caused by the pecking of other adults.

It was not until the fifth of October that I found a way to leave the island. Meanwhile I accepted an invitation to fly over Ascension in a bomber, and thus gained a much better knowledge of the island as a whole. The eastern side is formed mainly of light gray rocks, and contrasts strikingly with the burnt-brick appearance of the western half. One amazing sight was the Devil's Riding School, a crater that contains a veritable amphitheater with concentric ovals of pale gray, light brown, and yellow encircling a flat, dark brown center.

Bombers were passing daily on their way to Africa, but I had to wait for a vacant seat in a transport plane. That vacancy came only as a result of a minor mishap. The Stratoliner Navajo, taxiing out to a take-off, punctured one of its huge tires, and a spare had to be flown from the mainland. Chief of Police Eckel of Accra, becoming impatient, found room in a bomber, and thus his place was available for me. As we circled the northern corner of Ascension in the early morning of October 5th and set off for Africa, I cast a last fond glance at the white bulk of Boatswain Bird Islet, wishing I might have been able to study its bird population as well.

Ever since 1942 the fortunes of the wideawakes have been even more on my mind, and I have gained valuable information from Mr. Thomas Dodge, Colonel J. N. Tomlinson, and several American officers who either were stationed on Ascension or called there on transatlantic flights. The dates of return and of egg-laying have been noted from the last quarter of 1941 to the early months of 1946. Thus far the interval between successive returns has averaged 9.3 months. A month or six weeks after the return, eggs are expected, and the eggs are known to be incubated for 26 days. The young must be six weeks old before they can take wing, and six months elapse between the arrival and the final departure of the terns. The birds are usually able in this time to repair the evil effects of inclement weather, raids by cats, egging, or even a local catastrophe such as we had caused.

Every time the birds came back they gave some worry to the Air Force, as I had foreseen. It was reported that in 1943 some 23,000 eggs were gathered from the nuisance area by the Quartermaster's men, nor were these the total harvest. At times jeeps were sent out at night to keep the birds in the air and prevent interference with early-morning take-offs. Flares and Very pistols were employed, and sometimes even shooting was resorted to.

Colonel Tomlinson reported that at the beginning of 1946 the wideawakes were no longer attempting to nest near the end of the air strip, although the usual numbers had come back and were breeding actively elsewhere. One American officer has written me: "It is my belief that the terns will win out in the battle for Ascension!" I hope he is right.

Each time the wideawakes leave Ascension they seem to scatter out over the ocean rather than migrate toward other islands or coasts. The birds are rarely seen along the shores of West Africa. Four times I have sailed through the Gulf of Guinea, and only once did I see a party of about eleven sooty terns, between the islands of Annobon and São Tomé, on July 9, 1930.

How they spend their nights at sea is a mystery. Their superb homing ability has been demonstrated during controlled experiments. How tragic would it be if the Wideawake Fair of Ascension were to be seriously depleted. It has survived World War II successfully, and I doubt that the airport will be needed for commercial air lines of the future. I should be happy to see nesting wideawakes crowding up once more against the black pavement of the air strip which served so nobly during a global war, and even occupying stretches of sand that may well drift over it if the world-wide longing for peace is realized.

▼A LARGE BURNT-OUT PHOTOFLASH BULB replaces the egg. "The spot is right, but texture and diameter are wrong," the returning bird seems to think, for it doesn't even try to roll the globe under its breast

↘ IS SIZE more important than shape or texture? The bulb is buried until only the brass base protrudes. One tern settled down—but not for long. However, when a smaller bulb was substituted, the bird incubated it for a few minutes

SAY

Photo from Ewing Galloway

THE art of handwriting and the art of painting are termed sister- or twin-arts in China. Both have the same exacting standards, both require a talented hand, both are cultivated with the same passionate sense of the aesthetic, and both are held in high esteem by the people.

Thus, when a Chinese picks up his brush to compose a letter or to create a poem, he starts out with the same enthusiasm as the artist about to begin a picture. In China, a good calligrapher is usually a good artist, and in both the manuscript and the painting, the keen observer will see the same standards: the sense of harmony and space, the lines of beauty in composition, and the indication of subtle movements. Animation in artistic expression is the basis of all notions in Chinese art. Like the painter, the good calligrapher requires years of persistent practice to attain the supple wrist and nimble fingers necessary to express his full emotions through the brushstrokes.

The development of Chinese characters down through the ages makes a fascinating story in itself. More than 40,000 characters sit sturdily between the covers of the Chinese dictionary, and the origin of many of them is found in picture-writing from very ancient times. The idea of drawing pictures to represent objects is credited to a legendary figure named Ts'ang Chieh, who is supposed to have lived nearly 5000 years ago, in the period of Huang Ti, the Yellow Emperor.

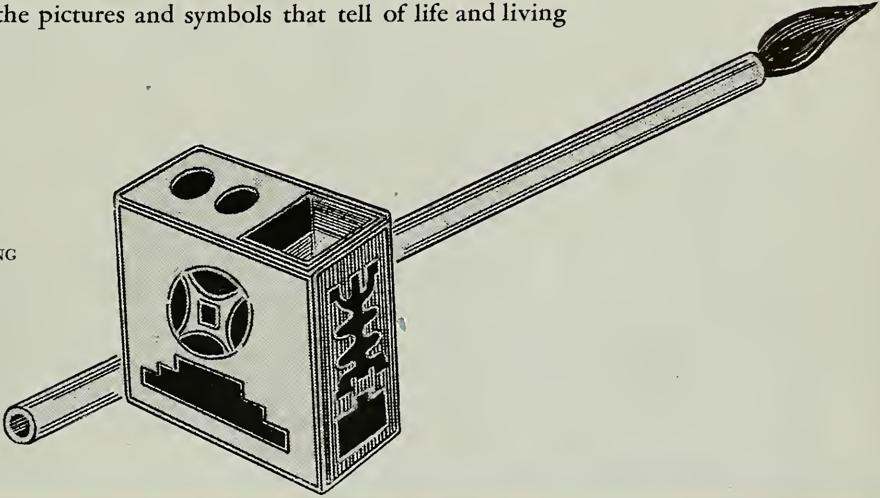
These early pictures were crude and were like the attempts of a child having his first drawing lesson. As time went on, the pictures became more and more stylized, and important changes took place. Pictures were combined and modified to represent abstract ideas, and they came to represent *sounds*, quite apart from the original meaning. Today we have a fairly stable literary language in clear-cut, uniform, and symmetrical characters. To know 7000 or 8000 of these is to be considered a well-educated man.

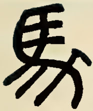
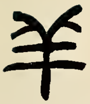
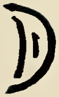
We can easily recognize many of the Chinese characters if we look at the more realistic pictures from which they evolved. The pictogram for "horse," for instance, used to show quite clearly an animal with a sloping back, a plumelike tail, and four legs. Today this has been simplified as shown at right.

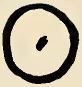
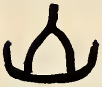
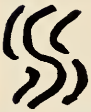
IT IN PICTURES

To the Chinese, handwriting is an art in itself—a fine art of painting the pictures and symbols that tell of life and living

By MABEL L. F. CHONG
Written characters by
YEEPING SHEN HSU



OLD FORM	MODERN FORM
	馬
HORSE	
	羊
GOAT	
	月
MOON	

OLD FORM	MODERN FORM
	日
SUN	
	山
MOUNTAIN	
	水
A WATERFALL	WATER

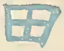
A picture of a goat showing curved horns and straight legs evolved into the character for "goat."

The ancient symbol for "moon" was the crescent form, which has been stylized as shown at left.

The "sun" was originally a circle and a dash. This has now given way to a rectangle and a dash.

The old symbol for "mountain" has likewise been simplified and stylized.

And a group of wavy lines suggesting a waterfall gives us the character for "water."

The character for "field" or "farm" shows the division of a square piece of land into four equal plots: 

Many other Chinese characters can be traced back to their original pictorial versions, but this is not the whole story of Chinese calligraphy. In any language, 40,000 different pictures for 40,000 different objects would be sure to result in a rather cumbersome and complicated system. Consequently, there are several other ways for forming characters.

One method is by repetition of a symbol. For example, if the character for "tree" is duplicated, it means "forest." And if a third tree is added to this, we have another character, which, when written with "forest," becomes a compound noun meaning "a deep woodland."

The character for "door" is a picture of two gate posts forming an archway. When the gateway to a shrine is added between the gate posts, we have the verb "to open," as shown at right.

木 TREE	+	林 FOREST	=	森林 DEEP WOODLAND
門 DOOR	+	开 GATE TO SHRINE	=	開 TO OPEN
門 DOOR	+	一 BAR	=	閂 TO CLOSE
門 DOOR	+	口 MOUTH	=	問 TO ASK
門 DOOR	+	耳 EAR	=	聞 TO LISTEN
人人 TWO MEN	+	土 GROUND	=	坐 TO SIT

人 MAN	+	言 WORD	=	信 BELIEF OR FAITH
日 SUN	+	月 MOON	=	明 BRIGHT
女 ONE GIRL	+	子 ONE BOY	=	好 GOOD
日 SUN	+	木 TREE	=	東 EAST
取 TO SECURE	+	女 GIRL	=	娶 TO MARRY
女 GIRL	+	家 FAMILY	=	嫁 MARRIAGE OF A WOMAN
目	+	垂	=	睡

If the symbol of a bar is added between the gate posts, it forms the character "to close."

A mouth placed within the door forms a character that means "to ask." And an ear symbol inserted in the door means "to listen" or "hear." Three ear symbols together means to "plot," "whisper," or "conspire."

Two men squatting on the ground form the character meaning "to sit."

At left are some samples of what can be called the *suggestive* group of characters. The symbol for "belief" or "faith" is simply a man standing by his word.

And when the sun and the moon are combined, the meaning is "bright."

Since the family is an important unit in the Chinese social system, it was natural for the people to combine the words "one girl" and "one boy" to form the adjective "good."

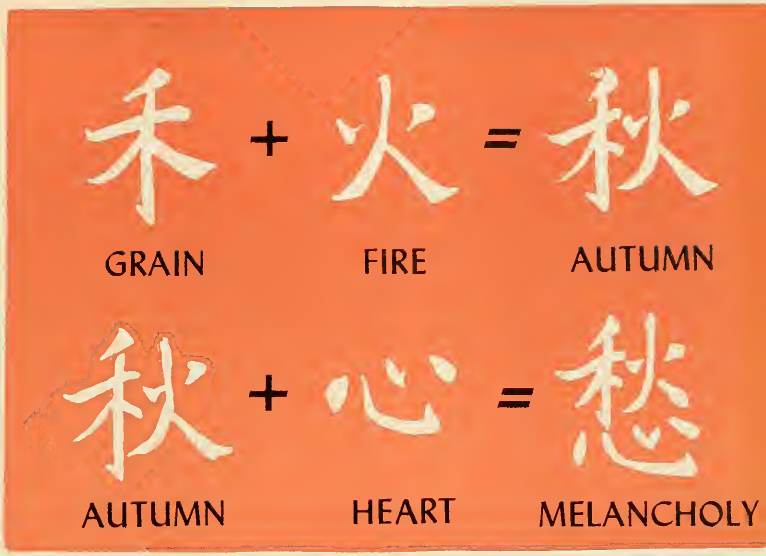
The character for "east" is a combination of the word for "sun" and the word for "tree" to show the sun shining through a tree as it rises each morning in the eastern sky.

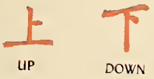
When the verb "to secure" is combined with the noun "girl," we get the character for "to marry."

This character, however, applies only to the marriage of a man. An entirely different character is used to represent the marriage of a woman. This is made up of the symbol for "girl" and the symbol for "family," signifying that when she marries she enters another household.

The character meaning "to sleep" shows the use of a symbol figuratively. It is made up of the character for "eyes" and the one for "to let fall."

Another group of characters, called "indicating words," can be illustrated by the ones meaning "up" and "down."





There is a picturesque and poetic quality to many Chinese characters that would be hard to match in any other language. For instance, when you combine the symbol for "grain" with that for "fire," you get the character for "autumn"—the season when the fields are burned by the sun. And when you add to this the "heart" symbol, which incidentally is a pretty good picture of a heart, you get the character for "melancholy"—the mood of the dying year.

There are, of course, many ideas that cannot be represented pictorially. And the problem in Chinese is complicated by the fact that as many as 20 unrelated words sometimes have the same pronunciation, with variations in tone. If this seems strange, remember that we have the words "pear," "pair," and "pare."

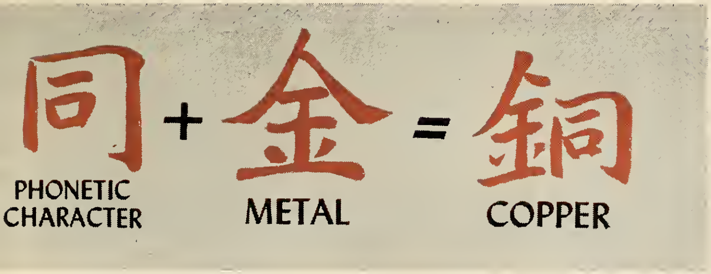
Things that can be classified in groups are sometimes indicated in written Chinese by two characters in combination, one to indicate sound and the other to indicate the group to which the thing belongs. Thus the character for "copper" is made up of a symbol giving the pronunciation of the Chinese word for "copper" plus the symbol for "metal."

Other metals are also represented in Chinese by the symbol for "metal" in conjunction with other characters.

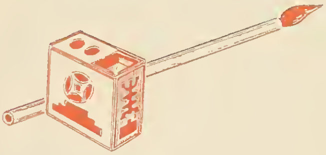
The character meaning "to eat" is similarly used in combination with other characters to represent a variety of ideas having to do with food, such has "hungry," "to drink," "rice," "dumplings," "to nourish," "cake," and "sugar."

These are but a few of the many ways in which Chinese characters came into being, but they are among the most interesting. The Chinese written language is one of the greatest of all cultural contributions to the world. It is an invention originated by the Chinese, and it boasts many interesting features not found in other languages.

Chinese children are taught from infancy to become adept with ink and brush, through which they freely express themselves in form and rhythm. As they dip their *pi* (brush) in Chinese inkstone and begin to trace out simple characters on rice paper, the profound words of a wise old Chinese sage come back to them:



"He who can handle
a writing brush
will never have to beg . . ."



MAN AND HIS BAGGAGE

By Clark Wissler

Curator Emeritus, Department of Anthropology, American Museum of Natural History

All along the rough road from savagery to civilization man has found it an increasingly complex problem to carry the things needed for life

MAN alone of all the creatures of the world carries baggage. Animals often carry food and building materials to their "nests." And they sometimes migrate to distant points, but they carry no baggage with them. People, on the other hand, are apparently never so primitive that they do not carry something in the way of baggage. This and speaking a language are their most exclusively human traits.

Chimpanzees in captivity show astonishing cleverness in learning to use some of our baggage, but when allowed to escape, they abandon such objects without hesitation, nor do they entertain any observable impulses to replace them with gadgets of their own devising or selection.

Museum collections pertaining to man are for the most part samples of his precious baggage. Many of the objects in early man's traveling kit are sufficiently indestructible to tell us when and where he first appeared upon the earth; and the current of his history from that remote time to the present can be read in the rows of cases in your nearest large museum. The museum materials are so real, so much a part of human life, containing, as they do, the unimpeachable truth about our ancestors, free from designing falsifications, that they are the unfailing rock to which we can anchor our faith in the reality of extinct races. Without these relics of the past, students of man would only flounder in a lost world of senseless make-believe.

The parts of man's baggage on which the objective science of archaeology is based range from bits of shaped stone and a broken or carved bone, to skillfully fashioned metal objects. As just stated, none of the existing apes habitually construct artifacts or carry such objects about with them, nor can we assume that they ever did. Thus it is that when a curious apelike skull is found in bedrock, or in compact earth, the decision as to whether it is human or simian awaits the finding of artifacts associated with it or with other skulls of the same species. The use of fire is one of man's earliest habits, so when an obvious fireplace with ashes and charcoal is found near such a skull, it is pronounced human. Yet the additional discovery of artifacts is even then awaited as confirmation.

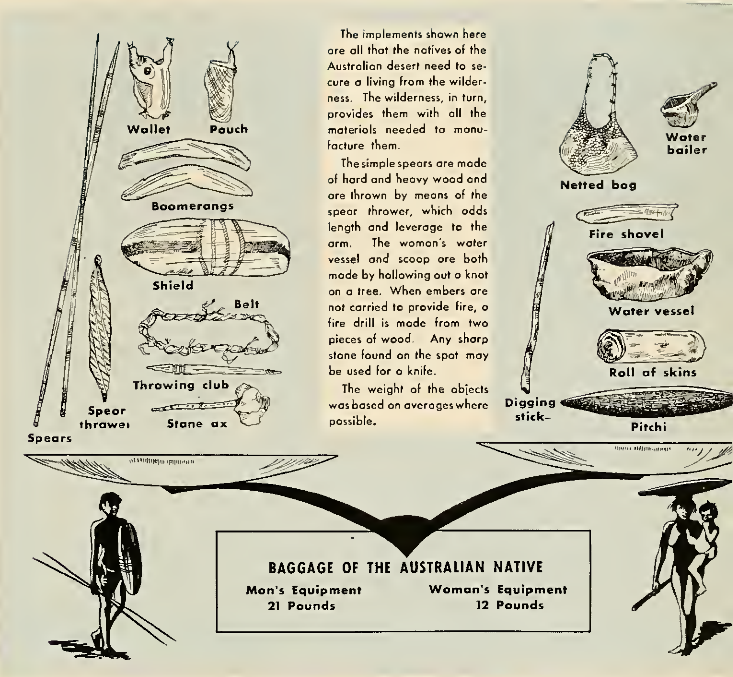
Is fire a part of man's baggage? It certainly was and is: we still carry matches. The simplest savages observed by the writers of books, either carried living fire with them or implements for rekindling it. These may not have been the first pieces of baggage to be carried, a club or a stone hand-axe may well have been the first. All this shows us how impossible it is to conceive of a human way of living without baggage. If any other form of animal has ever appeared with such a trait of behavior, neither paleontologists nor archaeologists have ever discovered him.

It is natural that there have been many inventions to increase the amount of baggage a family could transport. Many inexperienced museum visitors overlook the most commonplace devices, such as baskets, bags, nets, pack-lines, carrying frames, belts, pockets, etc. Even a simple twisted string or strip of skin may have been a great invention in the beginning. The lowly Tasmanian women knew how to twine together certain green blades of plants to provide a crude container for carrying home the clams they dug on the seashore. Both they and their men tucked bits of flint and other small tools into the whirls of their hair, the forerunner of the pocket.

Among every people some individuals have fewer than the average number of objects considered desirable when on the march, whereas others have more. In relative terms the rich and the poor have always been found in every community; they will certainly be with us to the end.

THE AUSTRALIANS CARRY MINIMUM BAGGAGE

The aim of this article is to compare the baggage carried by a few contrasting geographical types of mankind. The aboriginal natives of the more arid parts of Central Australia seem to carry the least of any people known to us. A possible exception may be the Bushmen of South Africa. These two groups run about an even chance to qualify as the world's champion light travelers. In the first place, the Australians wore no clothing until required to do so by the encroaching white population. Thus they had no need for packing reserve clothing. The average baggage load carried by an Australian woman would comprise a large shallow wooden dish, called a *pitchi,* usually balanced on the head on a pad of fiber or skin and steadied if need be by a free hand; one or two small woven or netted bags for food and trinkets; a wooden, or bark, water bailer, used


Wallet
Pouch
Boomerangs
Shield
Belt
Throwing club
Spears
Spear thrower
Stone ax
Netted bag
Water bailer
Fire shovel
Water vessel
Roll of skins
Digging stick
Pitchi
BAGGAGE OF THE AUSTRALIAN NATIVE
Man's Equipment 21 Pounds
Woman's Equipment 12 Pounds

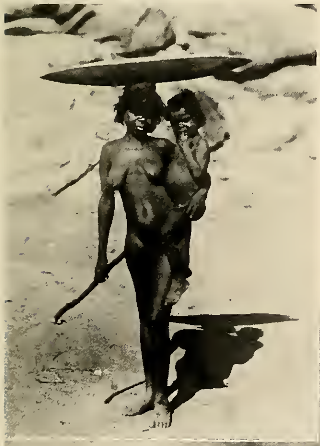
The implements shown here are all that the natives of the Australian desert need to secure a living from the wilderness. The wilderness, in turn, provides them with all the materials needed to manufacture them.

The simple spears are made of hard and heavy wood and are thrown by means of the spear thrower, which adds length and leverage to the arm. The woman's water vessel and scoop are both made by hollowing out a knot on a tree. When embers are not carried to provide fire, a fire drill is made from two pieces of wood. Any sharp stone found on the spot may be used for a knife.

The weight of the objects was based on averages where possible.

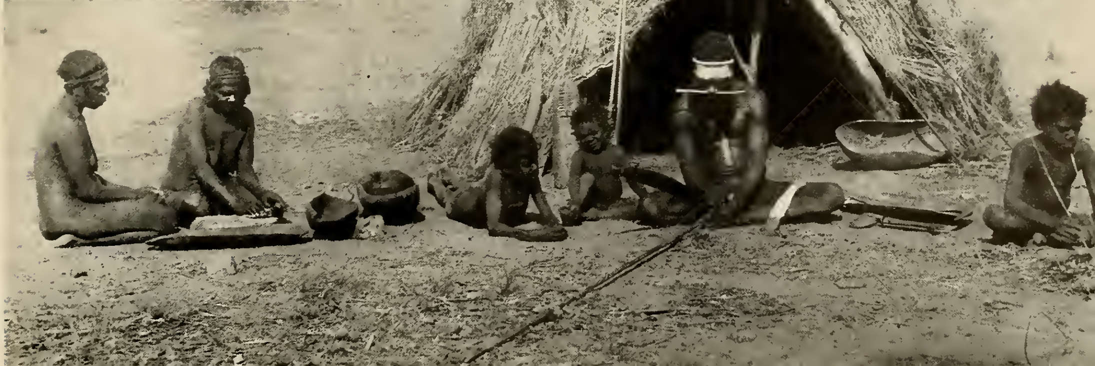
Drawing by the Museum Illustrators Corps

Sir Baldwin Spencer photographs



◄ THE LARGE WOODEN BOWL, or *pitchi,* is an indispensable part of the Australian woman's equipment. On the march, she sometimes fills it with other baggage

▼ A CAMP SCENE among the Aruntas of Australia, showing the usual possessions of a family. The woman is grinding seed on a stone not usually carried. The man is smoothing the shaft of a spear by means of a piece of flint attached to his spear thrower



also as a scoop, drinking cup, etc.; a bark water vessel; a wooden fire shovel and cooking implement; a simple digging stick; and a small roll of skins for bedding. When on the march, the *pitchi* may be used as a container for all the other objects. When the water vessel is filled, it is suspended from one arm.

We have weighed these objects in our museum collections; they approximate 12 pounds. To the full load carried by a woman we should add the weight of a small child, usually held against the mother's body in the crook of one arm. Should a man possess two or more women, each would, for the most part, carry duplicates of the same objects. Thus, including the infant, the full load for a woman might range from 20 to 30 pounds.

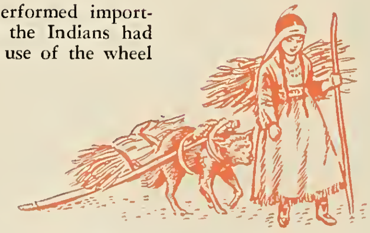
The Australian man will carry two or three long slender wooden spears, a wooden spear thrower, one or two short throwing clubs, a pair of boomerangs, a wooden shield, and a stone hatchet. The spears may be carried in one hand, the shield suspended from the shoulder, the clubs and axe under a slender belt made of human head-hair. In addition, the man may suspend from his belt a wallet, braided of hair-cords, containing a supply of hair for twisting new cord, and a wallet of skin, for charms, feathers, bird down, etc. The men are expected to be on the alert for game and enemies, to pursue or flee as the occasion requires. Likewise the women must be ready to run at full speed at any moment, holding on to their baggage.

We found the weight of the objects carried by a man to approximate 21 pounds.

The popular belief is that the savage woman always carried the heavier load, yet here the loads for women and men are about equal. However, if food is carried, it is added to the baggage of the women. Even so the family baggage would scarcely exceed an average of 46 pounds.

The usual question is, "Why didn't the Australians carry more baggage?" Perhaps under the conditions imposed by their way of living this was about all that could be handled. We see that they must run swiftly in case of need. They possessed no beast of burden, and seem not to have hit upon the idea of enslaving captives as burden bearers. Life was democratic in that each must carry his own baggage. The individual's desire for luxury was curbed by his strength. To secure adequate food he must more often abandon what he could not carry. However, we note ingenius devices to combine several tools in one. The *pitchi* was for the most part a food-bowl, but when in camp it might serve as a cradle for the baby. We have seen photographs of women rocking the baby to sleep by tipping the *pitchi* between their feet while their hands were otherwise engaged. The man's spear thrower was sometimes equipped with a small stone blade, a handy tool for cutting, scraping, carving, and many other operations. Again, the edge of its shaft was used as a firesaw to kindle new fire, or a war club in hand-to-hand fighting. Women used the digging stick for a club and its end for a stabbing and cutting implement. Travelers often tell us of a gang of angry women armed with digging sticks driving a loafing, philandering man from the camp. Devices for carrying live fire from one camping place to another were in constant use, thus avoiding delay and annoyance in kindling new fire by wood friction. Yet all speculations as to "Why so little baggage" are probably futile; it should be enough to tell what they actually did carry. Science is often impotent to tell you "Why," but may be able to tell you "How."

➤ THE TRAVOIS performed important tasks, because the Indians had not developed the use of the wheel



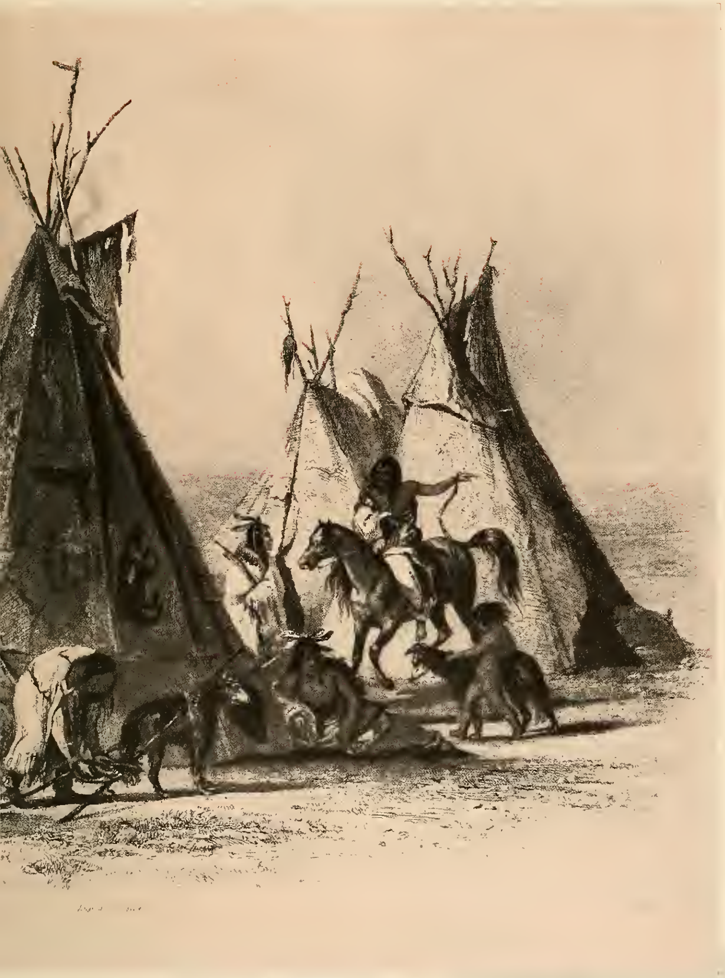
Drawing by the Museum Illustrators Corps

THE NOMADIC PLAINS INDIANS

The Plains Indians lived in moderately arid country but with sufficient grass coverage to support herds of buffalo, antelope, and other grass-eating animals. The buffalo were the most numerous. The food problem of these people was simpler than that of the Australians, yet its solution was not so easy as we may imagine. To make his daily kill of food the Indian was forced to follow the drifting herds of buffalo. Permanent housing was impossible.

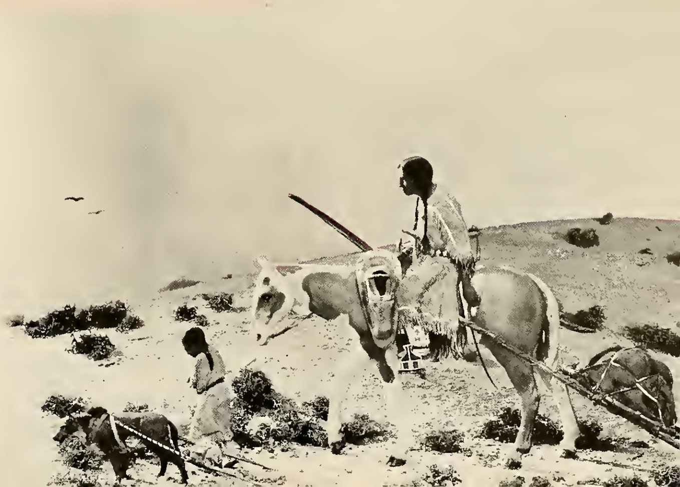
The earliest exploring expedition into the Plains country was the Spanish Coronado expedition of 1540-42. The translated annals of that expedition should be interesting to our readers. The scribes of the party were familiar with the farming, sedentary Indians of Mexico and what is now New Mexico. After proceeding many days across the plains they came to a settlement of 200 tipis and noted the sharp contrast in the way of life of these Indians:

". . . These houses were made of skins of the cows [buffalo], tanned white like army tents. The maintenance or sustenance of these Indians comes entirely from the cows, because they neither sow nor reap corn. With the skins they make their houses, with the skins they clothe and shoe themselves, of the



From the Maximilian Atlas

⮝ Two trailing poles carrying a platform or net and drawn by a dog was the traditional method of carrying baggage among the Plains Indians. This scene showing Assiniboin camp life was drawn more than a century ago



A.M.N.H. photo

➤ When the Indians acquired the horse from the white man, the travois became even more useful. From a model depicting the life of the Blackfoot Indians skins they make rope, and also of the wool; from the sinews they make thread, with which they sew their clothes and also their homes; from the bones they make awls; the dung serves them for wood [fuel], because there is nothing else in that country; the stomachs serve them for pitchers and vessels from which they drink; they live on the flesh; . . . they have no other means of livelihood. . . . [they] travel around with these cows, moving with them. They have [many] dogs, which they load, which carry their tents and poles and belongings . . . they make saddles for them like pack-saddles, and they fasten them with their leather thongs, and these make their backs sore on the withers like pack animals, . . . they have the poles of their houses dragging along tied to the pack-saddles, besides the load which they carry on top, and the load may be, according to the dog, from 35 to 50 pounds.

"The sun is what they worship most."[1]

No one since that day has penned in so few words a clearer characterization of Plains Indians' nomadic life. Practically all their physical needs were supplied by the buffalo. Their whole round of life was adjusted to the habits of that animal. It is clear that the use of the dog as a beast of burden and a traction animal enabled these Indians to carry a great deal more baggage than the Australians could. Hence, we are moved to say that their standard of living was higher.

It is not definitely stated that Coronado's party saw the dog travois of later days. This was an A-shaped frame of two poles and a cross-framework, an invention seemingly suggested by the dragging poles and the pack-load. Obviously, a dog could drag a heavier load than he could carry on his back. The travois device was first observed in the northern plains by French fur traders, hence the name. That it was invented before the Indians came to use horses seems probable. When horses were acquired an enlarged travois was made for them. Yet dogs continued to be used long after horses became common, both horses and dogs appearing in the same cavalcade.

Available collections from Plains Indians of horse days dating from 1800 to 1900 suggest that the baggage carried in 1840 was not essentially different from that of 1540, except that a few trade-objects had displaced others of native make. We find that the average family outfit consisted of a tipi cover with twelve to twenty poles, a pair of back-rests and tripods for the same, two lengths of tipi lining or back-wall, 36 wooden stakes or tipi pins, and four buffalo robes for bedding. A woman's housekeeping equipment would contain a trade-kettle, spoons of wood and horn, a few small wooden or horn bowls, two or more water bottles of skin or paunch, a tripod for the kettle, a wooden kettle hook, sewing bags with sinew and bone awl, carrying straps, knife, stone maul, a steel axe, a bag of skin-dressing tools, toilet bag with hairbrush (tail of a porcupine), paints, etc., rawhide bags for pemmican and dried meat, a digging stick, a baby-board, extra saddles and horse gear, packing gear for several dogs, and a roll of tanned skins for new clothing.

The man had a bow, arrows and quiver, shield, lance, possibly a gun, stone-headed war-club, knife and sheath, fire-making tools, bag with paints, etc., pipes and tobacco, bundle of charms and ceremonial objects, extra saddle and horse gear.

The total weight of these objects as required for a man and woman was approximately 447 pounds.

Extra clothing for woman and man would add about 31 pounds. Children would require extra clothing, robes, toys, and games—about 17 pounds for each child. Thus a man with one wife and two children would require, on the average, 541 pounds, making no allowance for food carried.

So far we have weighed actual objects. In a camp of 200 tipis, such as noted by Coronado's party, we might well expect at least one family to a tipi. The total baggage of the camp can then be estimated at about 100,000 pounds. For the transportation of this, about 2000 large dogs would be required, and part of the daily kill of buffalo would have to feed these 2000 dogs and an indefinite number of pups. Naturally if the number of dogs was not adequate, surplus baggage had to be carried on the backs of the family. Dogs would seem a weak substitute for horses, but they were retained even after horse days and helped to place the Plains Indians in a formidable position, making them more mobile and raising their standard of living by increasing their baggage, or equipment for better living. Discovery of how dogs could be used in this way must have created a "boom" in the life of the Plains Indians. The white man's horse was a still greater gain. The Indians could mount upon his back, and by loading the baggage on horses and travois could move the whole camp quickly. For example, in 1877 the thousand-mile retreat of the Nez Percé Indians,

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[1] George P. Winship (Translator), *The Journey of Coronado 1540-1542 from the City of Mexico to the Grand Cañon of the Colorado and the Buffalo Plains of Texas, Kansas, and Nebraska;* A. S. Barnes and Co., New York, 1904.

under Chief Joseph, outdistanced a pursuing U. S. Army, though the Indians were moving their whole tribal cavalcade, including women, children, sick, wounded, and aged, with their tipis and family possessions.

Reindeer nomadism has survived almost to the present, so it has been possible to study it thoroughly as a way of life. The publications of the Jesup North Pacific Expeditions, conducted by the American Museum of Natural History, give full information. Large museum collections were made, showing the heavy baggage carried by these nomads as they followed their grazing herds of domesticated reindeer. Of all surviving nomads these were the grandest and the most powerful. They suggest to us the glory of the ancient nomads of Central Asia with their herds of cattle and horses. It appears that when the Siberian nomads began to tame reindeer they became even more nomadic than they had been as hunters of wild reindeer, because the ambition was to own larger and larger herds. The areas around the camps, as a result, were quickly overgrazed, necessitating more frequent movements to new pastures.

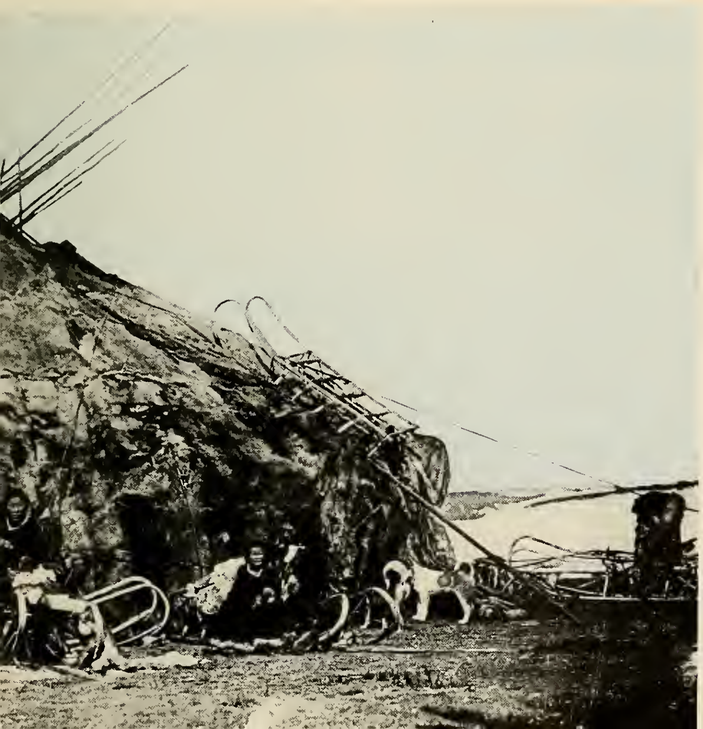
We note that the reindeer-skin tents of the herders were large and heavy. They were 25 feet and more in diameter and 15 feet high, circular but provided with vertical walls, like modern circus tents, supported by elaborate frameworks of poles. Several families would live in such a tent, so there were internal skin partitions that added to the total weight. The cold climate required heavy fur clothing and bedding. Large sleds were used for transport, and the amount of baggage was considerable. A camp, or band, usually comprised a minimum of five families, living in two or three large tents. With housekeeping equipment and personal property, 50 or more sleds were necessary. Such a camp would own some 400 reindeer, but a rich herder, leading a band of ten or more families, might own 5000 deer and at least 150 sleds, requiring 200 to 300 mature reindeer trained to harness.

The essential baggage items were tent covers, tent poles, bedding and rugs of fur, stools, lamps for heating and cooking, kettles, mauls, adzes, water vessels, wooden ware, knives, bellows, fire-making tools, drying racks, serving kits, mats, snow scrapers, shovels, food bags, etc. Among other needed objects were snowshoes, ice creepers, lassos, saddles, driving whips, harness, thongs, weapons, pipes and tobacco, tools for working bone and wood, and outfits for ceremonies, religious and otherwise. Extra clothing would be in the "must" class, such as fur suits, boots, caps, and mittens. Finally, a few extra sleds, too small for freight, were reserved for passengers only.

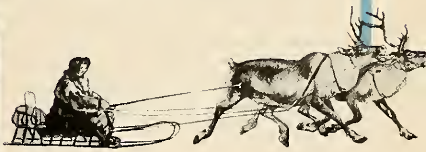
We did not weigh all of these articles available in the museum collections, since we were informed that two reindeer could draw a sled load of 200 pounds and that from 50 to 150 sleds were standard for a camp. So the baggage for individual camps could range from 10,000 to 30,000 pounds. For a single family unit of moderate economic status, the baggage load could be 2000 pounds in contrast to a Plains Indian unit of some 541 pounds and an Australian unit of 46 pounds.

With this information in hand we can say there is obviously a

A.M.N.H. photo



◄ In following their domestic reindeer, an encampment of five families of Siberian herders would need 50 or more sleds to carry their two or three 25-foot tents and household equipment. Reindeer were trained to draw these sleds as shown below



ANCIENT METHODS STILL PREVAIL

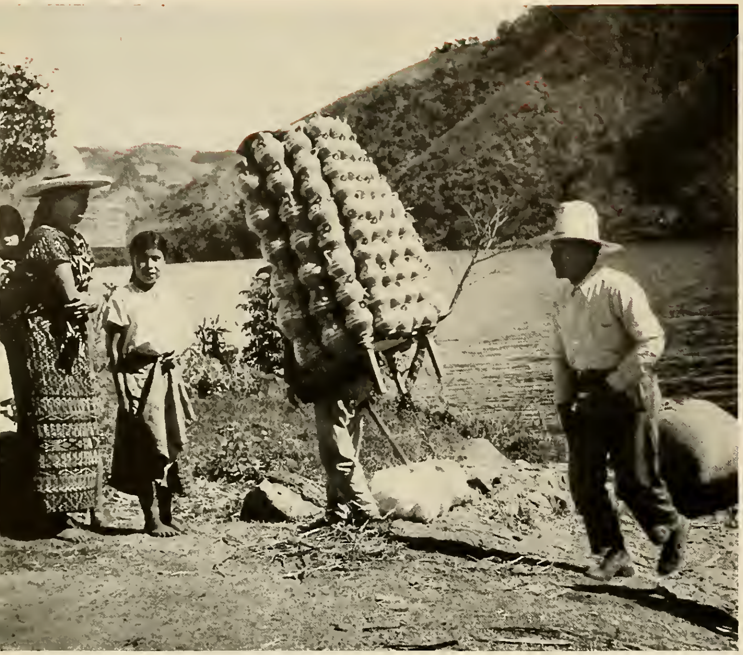


Photo from Three Lions

▲ In many parts of Central America, most of the native goods are still carried on the back—a hold-over from Aztec days. Modern Indians of the Lake Atitlan region, Guatemala

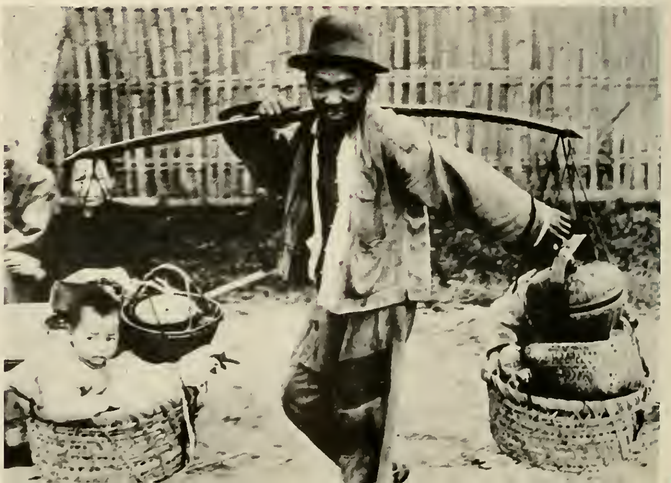
ratio between the amount of baggage a people carry and their way of life. If they domesticate large animals like reindeer, cattle, etc., they may possess a large amount of baggage and still be nomadic. If they are without such domestic animals and doomed to travel afoot, their load will be light indeed. There are intermediate levels, in which the people, because they must follow wild herds of reindeer, buffalo, etc., have increased their baggage by use of dogs and thus raised their standard of living above that of the Australians and the Bushmen. In previous articles we have shown that the domestication of plants is accompanied by drastic changes in housing, resulting in permanent villages and eventually cities and city-states, or nations, with corresponding increases in personal property. The domestication of animals also changes man's whole view of life and enables him to carry more and live better.

However, we must not apply these generalizations blindly, especially in respect to the relationship between ways of living and the size of the baggage load. For example, the ancient Mexicans did wonders without using carts or transport animals, but only human packers. However, they did domesticate plants. Here we can generalize with greater assurance: where there is no agriculture, populations are sparse, with very low standards of living. It is when both animals and plants are domesticated that large populations and great accumulations of personal property are possible. Recent history hints that draught animals may not be an important factor in the future, when man will be wholly dependent upon mechanical transport and may even produce his food by biochemical processes. Yet this threatens to increase his baggage to larger and ever larger proportions.

Some recent applications of scientific principles lure man to expect great advances in the use of atomic power, but realistic thinking offers no hope of escaping an overwhelming load of new baggage, unless man casts off civilization and returns to savagery. That he will do so willingly seems unlikely. So he must bravely face the future, striving for more mechanical devices to carry and house the increasing load.

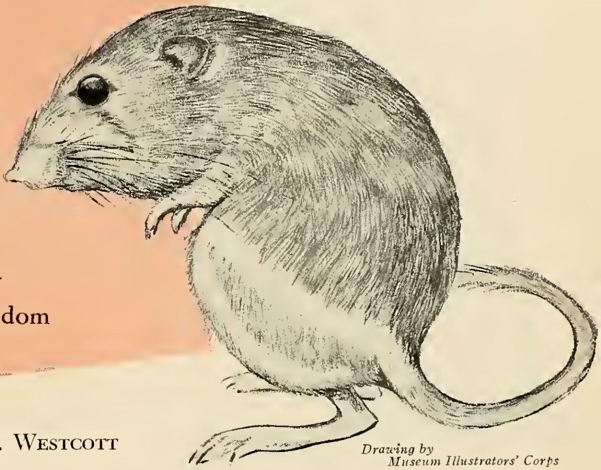
▼ With a baby in each basket, the Chinese refugee can move his family great distances on foot, even when he lacks the traditional wheelbarrow

Boury, from Three Lions



"Brains"

The story of some fighting men, a "mouse," and an idea called Freedom



Drawing by Museum Illustrators' Corps

By Rouen J. Westcott

WE first saw Brains as he crawled under the tent flap and gazed around inquiringly at his new neighbors. At first glance, he looked much like a common mouse of the Mickey, Minnie, or Field variety, but on closer inspection he proved to have some fascinating variations. First, and most spectacular of all, was his amazing tail. It was much broader and longer than an ordinary mouse's dorsal appendage, and was punctuated at the extreme tip by a tuft of hair. This tail was obviously what had earned him the name Bannertail, and he used it very cleverly in hopping about and balancing himself. His front legs were very short and were not used for the purpose of locomotion but, as we learned shortly, were employed as feeding aids.

The sudden appearance of this strange creature caused our conversation to die abruptly and all eyes were fastened on the visitor. Brains took hold of the awkward situation by advancing in a series of confident hops to the center of the tent and surveying each of us with a friendly glance. This display of poise and courage immediately broke the ice and we set out to establish friendly relations with our tiny guest. Luckily one of us had a package of peanuts that had been obtained to augment our nightly rationed bottle of beer. Selecting a choice nut, he rolled it over to our visitor with reassuring words intended to allay any fears lurking in the little rodent's mind. This precaution proved unnecessary, because the nut was promptly approached without any sign of fear. Picking it up gracefully with his forepaws, Brains casually deposited it in his mouth. It was at this point that we naturally expected to witness a delighted expression of relish on the rodent's face, but this pleasure was denied us. Instead, he merely looked up at his host with interest, and the fate of the peanut was a mystery except for a slight bulge in one cheek. One of the more astute persons present exclaimed:

"He isn't going to eat it. He wants more."

So we went through a process that was to be repeated many times in the future. We poured a little mound of nuts onto the floor and Brains proceeded to fill his oral shopping bag until his cheeks bulged to the bursting point. Soon he had apparently reached his load-limit and with one final courteous good-night nod, he hopped out of the tent.

It was at this point that Brains was christened.

"Now there's a smart little rat," one of us observed, "He's got *brains*."

So by common agreement among the interested parties, our friend was known, from that time on, as Brains.

Every night at the same time, Brains dropped in for a call. The peanut routine became a ritual that was performed with dignity. It was a ceremony to which all of us looked forward. Training for war out on the desert was hard work, and any small escape from the monotony of our life was eagerly grasped.

As the months passed, Brains became more and more a part of our evening entertainment. He seemed to enjoy the visits as much as we did, and not from the gourmet's point of view either. A Kangaroo Rat's social life must be very limited and the advantages of his contact with people were obvious. It was an opportunity for Brains to

Continued on page 341

▲ "HE-WHO-CAN-RUN-LIKE-WATER" (Di-a-duma), who has been given a loin cloth by one of the author's men, is still afraid of the camera. Life with the bow and arrow was so uncertain that the Watindigas were in danger of extinction

Africa's Cave Folk

ON A NEW TRAIL

The future of the Dark Continent looks brighter to a tribe of "stone age savages" who, with the white man's assistance, have transformed themselves into settled agriculturists in the past few years

By A. R. SIEDENTOPF[*]

Photographs by the author unless otherwise credited

AFRICA is still rich in natural wonders, but it has lost some of the atmosphere of mystery and peril that made it the Dark Continent. Its face has been remodeled by the war. New harbors dot its coast line, air terminals link its remote parts with all quarters of the globe, and modern conveniences are invading its ancient wilderness.

To most of its people the war was a strange, unknown thing. For some—livestock traders, stockmen, and farmers—war meant bigger profits; for others it meant work and good wages, money to buy gewgaws and luxuries. For a few it meant a chance to don the much coveted uniform of the army or police, with its prestige and authority.

For those living along the coast, war meant curfews and other restrictions in private and tribal life. For some in the interior, the internment of German and Italian planters meant the loss of jobs. The government only maintained essential, productive plantations.

But far in the interior of Tanganyika Territory lies a rugged district, the wildest country in a great wilderness. It is crossed by only a few brooks and larger creeks, which in the rainy season become menacing torrents but in the long dry period shrink to nothing. This secluded country, encompassed by the precipitous Serengetti tableland and by primeval mountain ranges, and swarming with tsetse flies and mosquitoes, is the land of the Watindigas, like the remnant of a world that used to be.

To the Watindiga, war had meant nothing. In a sense, they had always lived in a state of warfare, a continuous war for existence. And yet, this terrible and destructive conflict of which they knew nothing brought them the hope of a more stable life.

They roamed back and forth across this wild region, hunting to wrest their scanty living from nature, searching for wild berries, roots and herbs, and following the calls of the honey bird, which would lead them to a beehive in the hollow trunk of an ancient tree. Sometimes their feathered friend would give them a pleasant surprise, by guiding them unexpectedly to a drowsing rhinoceros. Expert bowmen that they were, they would soon kill the beast. The hunters would invite their relatives and friends to the banquet. The good spirits had condescended to give them a feast, so they would bury a piece of the meat in the ground beneath the animal as a tribute. Then they would stuff themselves until their stomachs protruded froglike and would depart only when the last bite of raw meat had been devoured and the marrow of the last bone sucked.

They never owned huts or hovels but sought shelter behind high cliffs, in crevices, in dense gulches

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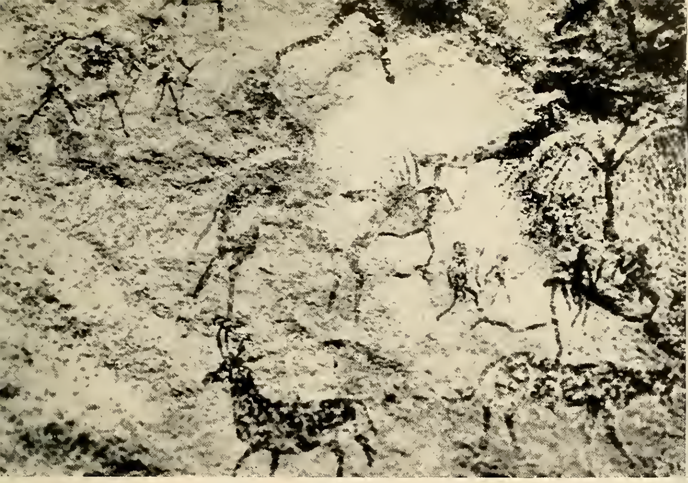
[*] A. R. Siedentopf was educated as an architect in Germany and emigrated to the United States 35 years ago. After traveling over most of the mountain country from Montana to Texas, always on horseback, he settled down in Colorado as a cattle rancher. In 1926, however, the wanderlust hit him again, and he set out for Tanganyika, East Africa.

As a licensed African hunter he led numerous expeditions of noted sportsmen after big game; and as a civil engineer he surveyed new roads through jungles and primeval forests, and thereby came into contact with numerous native tribes of Tanganyika.

Early in 1939, realizing that war was inevitable, he registered with the Tanganyika Territorial Force. Three years later, he returned to the United States, where he is now engaged in writing and lecturing on Africa.—ED.



➤ ROCK PICTURES, which may have been made by the ancestors of the Watindigas many centuries ago

or canyons, or beneath tall trees with thick foliage and low-hanging branches. Sometimes they crawled into thickets to seek protection from rain, cold, and the predominant African east winds.

"Why don't you settle somewhere and learn to cultivate or raise livestock like other natives?" I once asked a Watindiga.

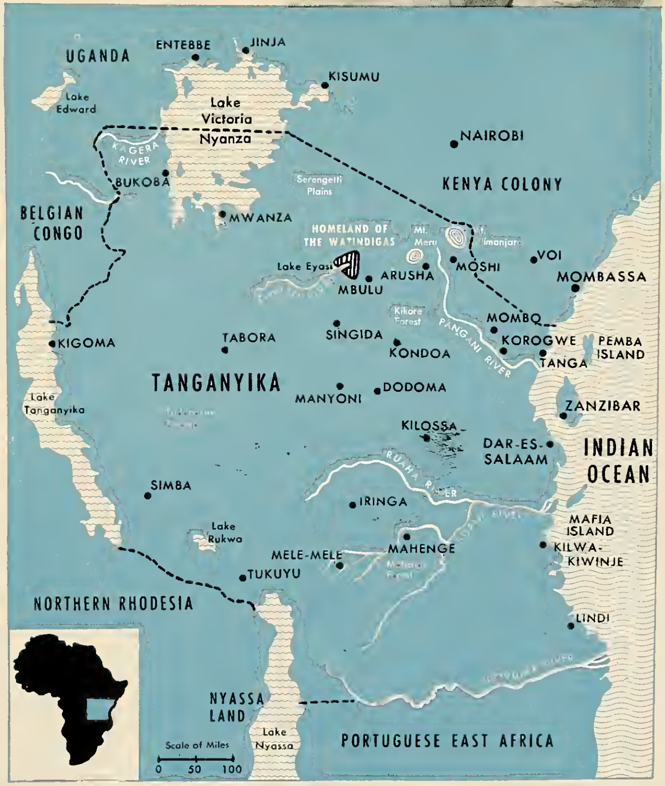
"Master," he replied, "once upon a time our good spirit asked if we cared to farm or raise cattle. But my forefathers replied, 'We prefer to wander around in the bush, to remain free as the game, and to live from nature.' Since then we have hunted. But the good spirit often gives us poor hunting. We have to go hungry for many days and bring numerous sacrifices to regain his good will."

Avoiding every exterior contact with Europeans and with most of the other natives, they seem to have guarded their seclusion so successfully through scores of generations that mere chance led to their discovery by the white man only about seventeen years ago. Stone implements indicate that the Watindiga may be survivors from the Stone Age. Today less than 400 of their people remain.

While other Africans adapted themselves to the changing times by gradual development and became tillers of the soil—patient,

➤ THE YOUNG ONES learned to grind corn into fine white flour

Photo by the District Commissioner of Mbulu, May, 1945


UGANDA
ENTEBBE
JINJA
KISUMU
Lake Edward
Lake Victoria Nyanza
NAIROBI
KAGERA RIVER
BUKOBA
Serengeti Plains
KENYA COLONY
BELGIAN CONGO
MWANZA
HOMELAND OF THE WATINDIGAS
Mt. Meru
Mt.
imanjaro
VOI
Lake Eyasi
ARUSHA
MOSHI
MOMBASSA
MBULU
Kikore Forest
MOMBO
PANGANI RIVER
KIGOMA
TABORA
SINGIDA
KOROGWE
PEMBA ISLAND
KONDOA
TANGA
TANGANYIKA
MANYONI
DODOMA
Lake Tanganyika
ZANZIBAR
KILOSSA
DAR-ES-SALAAM
INDIAN OCEAN
RUAHA RIVER
SIMBA
IRINGA
Lake Rukwa
MAFIA ISLAND
MELE-MELE
MAHENGE
KILWA-KIWINJE
TUKUYU
NORTHERN RHODESIA
LINDI
NYASSA LAND
Lake Nyassa
PORTUGUESE EAST AFRICA
Scale of Miles
0
50
100

▲ A TYPICAL WATINDIGA HOME before the people learned to build comfortable huts

Photo by the District Commissioner of Mbulu, May, 1945

↗ SLOWLY THE SETTLEMENT developed into a hamlet. Streets have been laid out, and the natives operate two of the stores that help to supply their needs

obstinate peasants, or shrewd, alert stockmen–, the Watindiga remained a primitive folk. Their mode of life continued to be a facsimile of the primitive past.

They were wild men—cruel, filthy, and versed in the dark secrets and deadly poisons of the jungle. Was it the idle, uncontrolled life with its dubious existence that fascinated them? Or was it only an age-old tendency to remain what they were? The white man after his first contact with the aborigines searched vainly for an answer; no one could give it, least of all the Watindiga themselves. Then followed a series of events which was to shape their future.

In 1935, a 2000-acre farm at the junction of the Bahri and Migungani rivers in Umbulu, the northernmost part of the Watindiga land, had reverted to the government. Six years of futile effort on the part of a European to develop this land into a coffee plantation had financially and physically ruined him. For the following three years this farm, with an elaborate irrigation system, lay idle. The soil was excellent for cultivation of maize, millet, groundnuts, and potatoes, an unprofitable kind of farming for white men in Africa.

There had been some official talk of settling Wambulu farmers and stockmen on this land, but their tribal leaders objected strongly and the scheme was dropped.

Two years later nature decided to take a hand. For three months torrential rains poured down on the country. Wind, cold, and fog followed, and for weeks and weeks the sun remained screened behind heavy clouds. The little wild men suffered terribly from hunger, cold, and illness. Through sheer luck I had again contacted the Watindiga and was living among them in one of their camps, which their chief Yaida insisted on calling his "village."

Behind some tall cliffs 105 human beings were scattered over a scanty, boulder-strewn area. Men and women, boys and girls, lived together in a mass. It satisfied the Watindiga to define the boundaries of each family or single man by two forked sticks on which the head of the household hung his bow and arrows. A strict taboo against trespassing over this imaginary line was still rigidly maintained as it had been throughout the endless ages past.

Twenty-five youngsters were critically ill—naked, dying children strewn on wet grass without any cover. The medicine from my tropical kit, the temporary shelter that my men and I had erected, and the blankets we had gathered from our camp proved futile to give relief, comfort, and warmth. In two days 22 of them had died.

"Why don't you do something to save the lives of your children?" I asked the stoical parents.

The unclad mother of two—already a knotted, stringy woman—spoke up, "As only weak children get sick, it is better to let them die young. They would never grow up into strong men and women."

I had come face to face with nature's ancient and cruel law: "to the strong, life; to the weak, death." They carried their dead into the bush where the scavengers of Africa—jackals, hyenas, and vultures—performed the last rites.

Five months later when I returned to my home in Mbulu, I had learned to like the little wild men, though I was not blind to their failings. I also thought something could be done to save this remnant of an ancient people.

The District Commissioner needed convincing. "What about the mosquitoes and tsetse flies?" he inquired. "And will the Watindiga settle down? The fact is, I have never seen any—only heard about them."

"Clear the land of thorns and drain the swamp," I answered. "As to the Watindiga staying put, that, of course, is another question. They may; I believe Yaida can be induced. A successful settlement would be a pretty feather in your hat. Try it."

The District Commissioner became greatly interested in the project. Letters were exchanged. Reports were compiled. The official file, "Proposed Watindiga Settlement," began to bulge, and a year later the matter was brought to a conclusion.

In December 1939, three months after Germany's invasion of Poland, the first 30 aborigines under Yaida were led to the vacant plantation. The District Commissioner and two native instructors from an agricultural school met them. An equal number of men from a neighboring tribe had been hired to help the new settlers in setting up suitable quarters.

Trembling and terrified, the little men came, persuaded into this mad venture by the solemn assurance of their chief and myself that no harm would befall them. They saw for the first time sharp axes, bush-knives, and hoes—all new things, and to them only deadly weapons.

"Tools with which to clear the land, build huts, and prepare the ground so that you can grow food for yourselves," it was explained.

They stood and watched the native instructor as he felled a small tree and converted the trunk into the center post for a hut. Some shook their heads, others laughed like happy children over a new toy, some sat on the ground and stared ahead with bulging eyes and wide-open mouths.

Not less strange was the issuance of clothes. They solemnly inspected and carefully handled the shirts and khaki shorts.

"To protect you from the cold winds and the fever that follows, which has already taken the lives of so many of you," they were told.

For a long time there was confusion. The right of possession was something so new, so incomprehensible, and at the same time so alarming that it would have been a great relief to them if we had taken everything back. I shall never forget the expressions on their faces when they were told to dress. They could scarcely manage to put on the garments for asking questions. When finally clothed, they appeared to be entirely different people. Hunching their shoulders, hitching their bodies, and awkwardly moving their arms as though they were encased in plaster of Paris, they paced about with a stiffness that is hard to describe. They took short steps, long steps, and bent over time and time again as if they expected the shorts to rip or fall off. When after a little while they had become accustomed to their clothes and discovered that they looked like other natives, they laughed again, happy and carefree.

And thus began the slow but steady education. It was by no means an easy task. It took an enormous amount of patience and perseverance to teach them the use of the hoe and axe. For weeks they suffered from backaches, from sore muscles, and from calluses in the palms of hands that hitherto had only pulled the bow string.

Suddenly a Watindiga came running. He had cut his big toe. While the wound was being washed and dressed, he said with a worried face, "The knife has bitten me. I am going back into the hills."

"If somebody shoots at you with the bow, do you run into the flight of the arrow?" I asked. "No, you don't. You dodge it by stepping to one side," and I showed him how to stand while using the sharp and heavy bush-knife.

The young native remained silent. The next morning he had left the camp, perhaps to return to his former existence.

The relocation work taxed the endurance of the European and the composure of the native instructors. One harsh word, the least display of annoyance or anger, would have stampeded the aborigines into the deepest wilderness.

During the initial weeks and months of their reformation, the government took special care of its protégés. They were well fed; native dispensers alleviated their ailments and illnesses; they were not permitted to work too long or too strenuously until they had gradually become accustomed to it.

To avoid the heat of the day, work started at five in the morning. Three hours later, an instructor tried to urge a young bushman to enlarge his small field.

"I am tired," the new farmer said. "I have already hoed a big patch," and he pointed with pride to his work. Any other native would have easily accomplished the task in less than an hour.

"You have done well," replied the white man encouragingly. "Now rest; if you increase your field tomorrow you shall receive an extra ration of food." The Watindiga readily agreed.

Thus days passed into weeks; weeks grew into months. Small, comfortable huts were erected, the land was cleared of dead coffee trees, water flowed again in repaired irrigation ditches. The plantation that had lain desolate and deserted saw new life once more: patches of green maize, small hills of blooming potato bushes, healthy runners of groundnuts creeping along the straight lines of ridges. Clearings had been cut into the thorn tree jungle, forcing the tsetse flies to yield conquered ground. The country around resounded to the bleating of goats given to the wild men by the government.

When the first heavy showers of the long rainy season soaked the fertile soil, the little men instinctively ran for sheltering thickets. The white man and his native assistants were drenched to the skin before they had rounded up their charges and led them back into the comfortable huts.

They stared at the roof, wide-

▼ Now the Watindigas laugh, play, and sing without fear. It is to be hoped that their tribal traditions can be preserved as part of man's obscure history on earth

eyed. "Rain will not drip through this grass?" they asked, cautiously feeling the thatch as far as they could reach. They could not seem to comprehend: "Do not the densest trees in the jungle leak water?"

Small fires were built, and soon the heat of the flickering flames filled their shelters with a cozy warmth. As they dried their wet clothes, they realized that they did not feel the cold wind on their naked bodies; and they suddenly remembered their friends, exposed to nature's forces. They were ready to bolt again but now to tell their fellow tribesmen about this wonderful place.

When in April, 1941, the equinoctial storms again raged over the land, over 90 aborigines had found happiness and peace in the new cantonment. The experienced eagerly taught the inexperienced.

The young native who had cut his big toe returned. There were cheers and shouts of welcome, for he had come back with his parents and his little brother. "It is better and safer to be here," he said. He wanted to explain everything to them and pointed out all the new gadgets as though they were his personal discovery.

Freed from worry and hunger and protected from their enemies, the friendly Watindigas disposed of their ancestral symbols of communication. In the wilderness they had communicated by signs cut into the trunks of trees or by tiny branches placed in certain directions in the grass near their narrow paths. With such marks, always fresh to avoid confusion, they gave directions or locations of camps, arranged for tribal councils, or warned of danger. Now they gossiped openly with a great deal of tongue-clicking and lip-smacking.

While the shadows lengthened, a Watindiga sat in front of his hut and whittled. A year or so ago he would have dressed a raw and thick shoot of a bush with his stone knife, intently, patiently, until it was transformed into a perfect bow. Now he prepared, diligently, a post for a crude wooden bed, using a sharp steel knife. "Our baby will soon be born," he said proudly, and after a moment added, "and the mother must not lie on bare ground."

I felt no cause for worry. The settlement would be a success, and it would mean a great deal to my friend, the District Commissioner.

With the coming of dusk, a small fire burned in every hut. Formerly, campfires had been considered dangerous as they would have revealed the aborigines' location to their enemies, but now the flames, visible through the open entrances, did not bring death. Three well-armed native policemen patrolled the settlement; not to keep the Watindiga in, but to keep their foes out.

One of the men had finished his supper. He belched loudly twice, according to African custom, as a sign of approval of a good meal.

"Is it not better than searching for berries or digging for roots?" he was asked.

"Much better," he replied cheerfully, "and look, I am no longer hungry." He patted his full stomach with great satisfaction.

Slowly the settlement developed further and further until it became a hamlet. Many huts have given way to more substantial structures. Streets have been laid out. One Indian and two native stores, *dukas* as they are called in East Africa, supply the needs of this small community. By slow degrees the little men have been taught the value of a coin.

They line up outside the square mud house that serves as a government office and wait to be paid for their farm produce. It is always exciting to be paid, and they look very cheerful standing in the hot sun. They talk of work and discuss what they can buy with their money. With jingling coins in their pockets they go to the stores to buy clothes, to barter for a few gewgaws that will delight their women, or to purchase soap. The Watindiga have learned to wash and bathe; they no longer wait for the rains to clean their bodies.

Many have married young women of their own tribe or of the now friendly Wanyiramba, who only several years ago barely tolerated their existence.

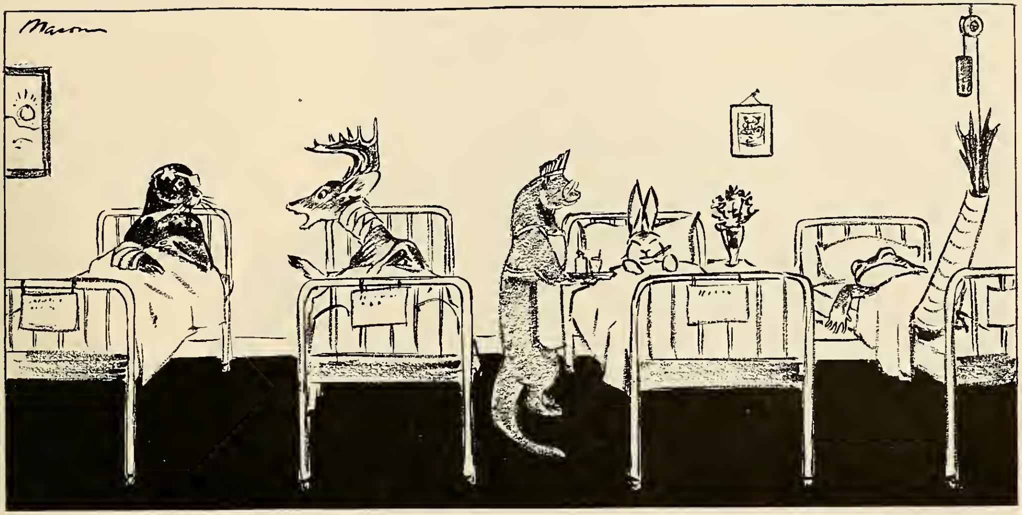
More than 200 Watindiga have now settled on the new land. A school will be erected in the near future and trained native teachers will come to coach the little woolly-haired children in Kisuaheli, the universal language of East Africa. They will be taught all the rudiments of a simple education. They will learn better farming methods, brick-building, pottery, and other useful crafts. With the winning back of a country formerly infested with tsetse fly, cattle will be brought to the Watindiga. A new dawn is breaking over an age-old battlefield.

All the mystery of their tribal councils and rituals, and the secret of their deadly poisons may die. History may never mention the herbs, roots, and barks with which their sorcerer or doctor concocted his medicines. It will be a pity to lose all this lore, for it is a part of the history of mankind. With the conversion of the aborigines, the taciturn medicine man passes on to his ancestors, his lips sealed. Sometimes the treasury of folklore can be tapped before the older people have all passed from the scene, and it should be.

War is a ghastly experience, and also a strange, mysterious thing. It destroys hamlets, towns, and cities. It brings grief and sorrow to millions. But to the Watindiga this war, which they knew nothing about, has brought only happiness and the prospect of a more useful future.

The war has changed the appearance of Africa along the coast and in many parts of the interior. It has drastically affected the existence of millions of people throughout the continent and has altered completely that of the Watindiga. For the first time since human life appeared in the Dark Continent, the Watindiga land looks green and peaceful from the air.

SELF-REPAIR



By John Eric Hill
Drawing by
G. Frederick Mason

ONE of the marvels of living things is their ability to repair injuries, to regenerate tissue, and to repulse invasions of bacteria or similar organisms. Wild animals have no doctors, and they live hazardously. The few individuals out of the many born each year that live to maturity have generally had to survive injuries of various sorts, and scars often remain—mute witnesses to the recovery.

The skin of a male sea lion or of a fur seal is commonly a mass of scars about the head and shoulders. After the fights that occur for harem grounds each year, the bulls have gaping wounds that would be serious indeed to man. The thick blubber layer under the skin usually prevents serious injury, and the wounds heal with little trouble. Occasionally a deer's skin may show the claw marks of a puma that failed to make its kill, and a rabbit's skin may bear the scars of an owl's talons.

Mammals often have great resistance to infection in wounds. The Norway rat and its color varieties used in laboratories will recover without infection from operations in the body cavity even when the surgical tools are not sterile. What would almost certainly produce death from peritonitis in a human patient causes the rat no trouble at all. This ability to overcome bacterial infection of wounds is widespread among wild mammals.

Serious injuries to the skeleton are also overcome. In every collection of skeletons there are some with bones that have been broken and have healed during the animal's lifetime. This is as true of prehistoric animals as of recent ones.

Sometimes a bone that was broken has knit as well as if it had been given the best treatment known to medical science. In this case only a small thickening and roughening of the area of fracture shows. But this is rare in naturally healed breaks. More often the broken parts are pulled past each other by the action of muscles. The two pieces of bone lying side by side then rub against each other if the member is used, tearing the membrane that covers the bones and stimulating new bone growth. This was the case with the shin bone of a deer that came to our attention at the Museum. The injured animal must have hidden away or, if it did move about, it must have held the broken limb motionless for a week or so. The bone had knit solidly and was stronger at the break than anywhere else. Although the leg was shortened and slightly misshapen, it was still quite usable, and the deer had lived some years after this serious fracture. Sometimes the broken limb bone knits at an angle. This slows down the injured animal for the rest of its life. But some partly crippled individuals manage to survive longer than might be expected.

A broken bone may not knit; the broken ends may each heal over and become rounded, forming a false joint. This commonly happens in the case of broken ribs. At least once such a "joint" developed in a frog that had broken the bone of its lower leg near the middle. In spite of this handicap, the frog was able to jump and swim almost as well as normal ones and was in good condition.

Animals show remarkable powers of repair and recuperation, but the story of the bird that splinted its broken leg with a stick and mud is sheer nonsense.

City-Bred *Duck*

By E. W. Pfeiffer
Photographs by J. S. Luck

◂ Portrait of a duck ha
who came to live in a large

AWKS

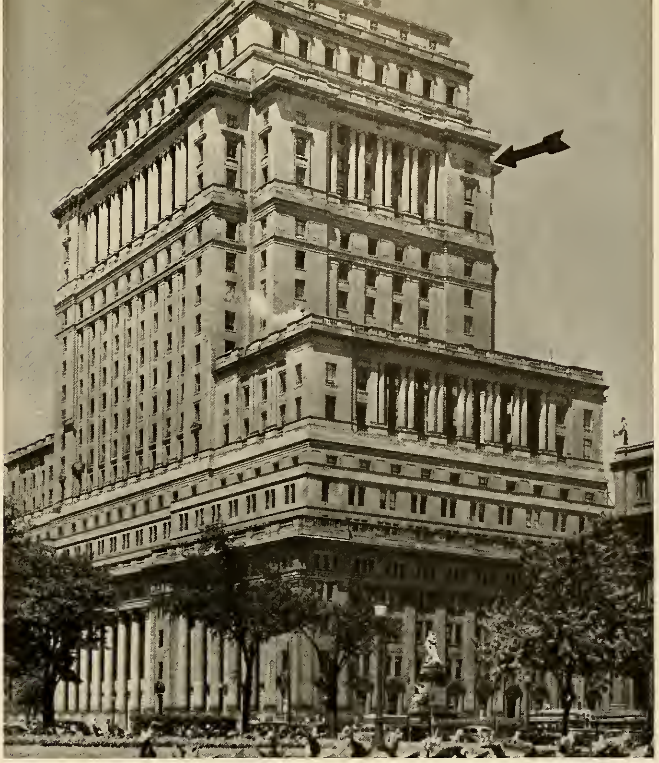
efying hazards, a determined falcon
ises her family on a ledge twenty
ories above a Montreal street

MANY large cities of the world have Duck Hawks as residents. The tall clifflike buildings and flocks of pigeons are a great attraction to them. But nesting facilities are often inadequate, and that was the case on the Sun Life Building in the heart of Montreal, where a pair of duck hawks have made their home for several years.

In the spring of 1940 I was working in a near-by building and had opportunity to observe these birds. For several years prior to this, according to local birdmen, these duck hawks had laid eggs in the gutter at the twentieth floor, but as soon as it rained, the eggs were always carried to oblivion down the drain pipe.

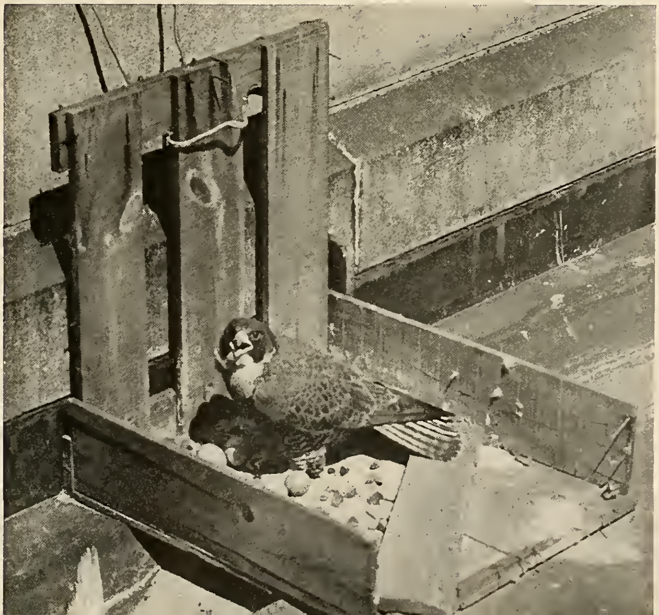
My friend, Mr. J. S. Luck, and I decided to help the birds. We placed two boxes filled with rubble and sand on the two corners of the twentieth floor ledge where the birds were most frequently seen. In March we were elated to find that a hollow had been scraped out in the box on the northwest corner. Some weeks later the falcon was observed brooding, and after prolonged observations, we were able to see that she had two eggs.

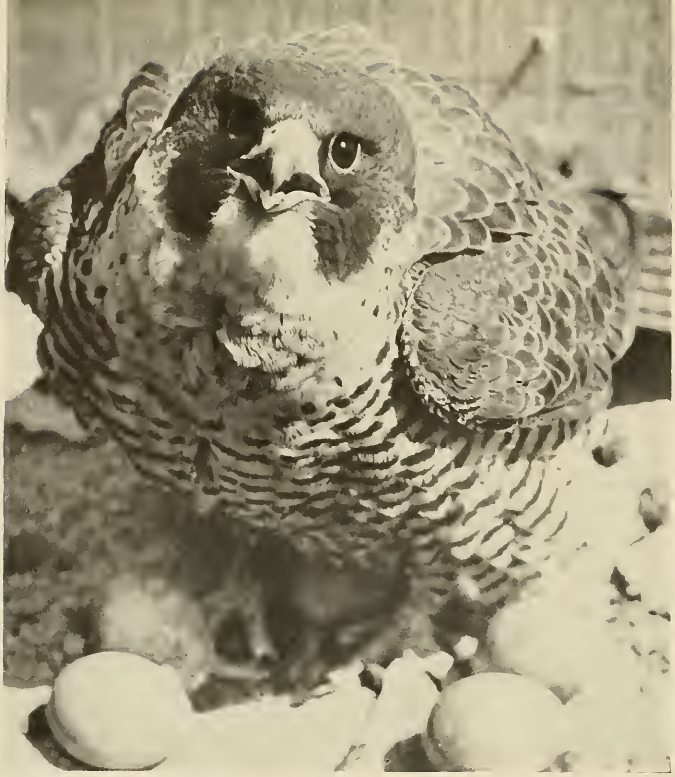
A peculiar thing then happened. She suddenly moved to the northeast corner box and laid two more eggs. However, after a few days she returned to the original box and laid two final eggs. She had evidently made up her mind and continued to brood these eggs until two eyases were hatched some weeks later.



▲ THE ARROW shows the ledge twenty stories high where the pair of duck hawks were determined to lay their eggs. As soon as it rained, the eggs were invariably carried down the drain, until the author attached two boxes for them

▼ THE MOTHER FALCON readily took advantage of the help that had been offered. In fact, she laid eggs in both boxes in one season before finally choosing one of them





◄ THE BROODING MOTHER was remarkably tame, but when sufficiently annoyed would take to the air, screaming and stooping in typical peregrine fashion

The nest was well placed for observation, and the birds were remarkably tame. One could peer over the balustrade directly at the falcon, and she would stare back with nothing more than a slight show of annoyance. At times she would take to the air and put on a display of flying that would warm the heart of any falconer, screaming and stooping at very close range in typical peregrine fashion. We could easily determine what the hawks were feeding upon. The main item was, of course, pigeons, with a considerable number of other birds, such as flickers and blue jays.

In the course of this work, Mr. Luck and I sometimes climbed over the balustrade to get close-up photographs. One afternoon around five o'clock when people were streaming out of the building, we caused something of a traffic jam in the streets below. A few days before, a local office resident had thrown himself from the tenth floor, and the morbid people in the streets were obviously waiting for a repetition of the thrilling spectacle.

Despite our intrusions, two young duck hawks were successfully reared both in 1940 and 1941. During rearing of the latter two, the entire family almost met its doom. The Sun Life Building managers chose this time to make some repairs on the outside of the building. A squad of a dozen or more men appeared on the ledge near the eyrie and were promptly and vigorously stooped at by the duck hawks. Quite understandably the men decided to retreat and complain about the falcons.

This eventually resulted in much debate about the fate of the birds, including editorials in the local press. An enthusiastic falcon fan finally arrived to show, as he insisted, that the birds were merely bluffing. Confidently he assembled the workmen in a safe place near the eyrie and stepped out to defy the hawks. Much to his chagrin and discomfort he was rewarded with a solid blow on the head by the stooping mother bird. After this happened a second time, he retreated in consternation.

By this time, the workmen had definitely decided against arguing with the falcons. They were finally persuaded to delay repairs and spare the birds.

Since this narrow escape, the duck hawks have managed to raise at least one eyas every year, and I understand that they are now viewed benevolently. They keep pigeons from the upper parts of the building and have even become somewhat of a municipal curiosity.

➤ YOUNG DUCK HAWKS shortly after hatching

THE SACRED WHITE BUFFALO ROBE

Continued from page 309

it out taut on the ground. Then another warrior told another story, and another hole was cut; and so on until the necessary number of holes had been cut all around the border of the green hide.

After the woman had trimmed slice after slice of surplus flesh from the hide to the accompaniment of further heroic stories, it was carried from the lodge by a warrior who had dragged an enemy from his lodge. Before the woman could stake out the hide in the center of camp, a warrior who had captured a female enemy had to count coup upon the tool she was to use. As the woman drove each stake through a hole, a warrior struck the hide at that point, as though counting coup upon it. And before the actual tanning was begun, the hide received an additional stroke from the leader of a successful war party that had returned without losing a man.

Great spiritual solemnity accompanied the whole procedure, and all the old warriors watched carefully to see that every detail was followed properly. If the hide was to be decorated, special ceremonies had to be observed throughout.

A tanned and decorated white buffalo hide was considered one of the most prized possessions of the tribe, and an enemy might plan an elaborate war campaign in the hope of capturing it.

Among some tribes the period of ownership was specifically limited. After a limited number of years, it was believed necessary to return the treasure to the Great Spirit, through the action of Rain, Sun, Snow, and the mystery of things unknown.

It is for these many historic and traditional reasons that the two live white buffalo in the United States are so interesting. They represent a total of about 5,000 buffalo that have been propagated and preserved for posterity through the efforts of the American Bison Society, the Fish and Wildlife Service, and various other Federal, State, and private organizations. All but a very few are confined within man-made fences. On the law of averages, we might have expected to wait several centuries before seeing a white buffalo. We now have two, both offspring of the same mother. They were born on the National Bison Range, a Federal Fish and Wildlife refuge on the Flathead Indian Reservation, Montana. Both are bulls. The first one was born on May 3, 1933. His name is "Big Medicine." He is entirely white except for a brown patch that runs across the top of his woolly head between the horns, giving him the appearance of wearing a small Eton cap. His eyes are of normal color, rather than the rose-petal pink of a true albino.

When Big Medicine was about 4 years old, in 1937, he and his own mother bred and produced a pure albino calf, completely white even to the hoofs, and with pink eyes. He was, however, born partially blind, and his mother abandoned him at birth. He is now in the Zoological Park in Washington, D. C. It must be said that his birth was not entirely in the nature of an experiment and was not condoned by the authorities. A repetition has since been carefully avoided. It must also be said, for the record, that the two-time white-calf mother has since shown no signs whatever of producing more albinos, although she has quite regularly shown herself an exponent of large progenity. But all of her calves have been bulls. As for Big Medicine, he, too, has been the father of a credible number of calves, but there has not been another white hair among them.

The saddest part of the whole story is that the many present-day Indians who have looked upon these two live white buffalo browsing on the lush grass of the National Bison Range in Montana, have merely grunted in casual curiosity—and continued on about more important business. Unfortunately, the white man has exterminated far more than the vast herds of buffalo that once roamed the broad plains of our Great West.

"BRAINS"

Continued from page 331

fill his larder and also to observe these strange visitors to the desert.

But one day orders came that terminated our work in Arizona, and we prepared to move on for training elsewhere. One of us in our tent group thought it would be a great idea for Brains to come along as a mascot. We all agreed because we knew that we would miss our companion and his nocturnal visits. So we devised a trap for him.

That night Brains appeared at his chosen time and found a little pile of nuts awaiting him. Just as he became engaged in the familiar process of filling his cheeks, we dropped a large glass jar over him. I must say that he took this treachery calmly. He made a few tentative tries at climbing the slippery glass, and then resigned himself to confinement. We picked up the jar from the floor and put it on the table so that the candle light shone on our little captive. He merely blinked at us through the glass, and his form, magnified by the curved surface, took on grotesque proportions.

As we turned in that night, there was little of the usual horseplay. Instead of exchanging friendly insults, each man seemed absorbed in thought. I lay on my cot for a long time watching the dry night wind disturb the tent roof. Faintly, on the table, I could see the outline of the prison we had created for Brains, and a vague feeling of guilt spread over me. Nothing tangible —just an uneasy feeling. Something wasn't right in this business. What right had we to take possession of our friend? Perhaps Brains had a family. He was probably the master of a home or the mother of a brood.

Carried away by this line of thought, I was soon viewing our simple deed as a vile crime. Unable to stand the self-torture, I threw aside my blankets and reached for the jar on the table. My sudden motion was arrested by a very quiet "Ssh!" from the other side of the table. As I hesitated, a hand grasped the bottle and lowered it to the floor. Quietly the cap was unscrewed and the glass container laid carefully on its side.

It was too dark to see the departure of Brains from his confinement, but I could hear the little clicking sound of his claws on the floor as he hopped away. His liberator slipped quietly back to bed with no sound except for the groan of his cot. Then the silence was shattered by a stage whisper from the far side of the tent:

"Good night, you sentimentalists. You beat me to it."

Soft chuckles echoed from cot to cot for the next few minutes. Just before I went to sleep, I made a mental note to find the best peanuts the PX had to offer and fill that ill-fated glass jar to the brim with them—for Brains. That's just what we did.

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LETTERS

Continued from page 297

The following letter on science and religion is similar to many that come to the American Museum. Because it embraces some of the main points in an unusually clear and complete way, we take the opportunity to publish it, with the answer by Dr. George Gaylord Simpson of the American Museum's Department of Geology and Paleontology.—*Ed.*

* * *

Sirs:

Would you please answer the following questions?

1. Is there a missing link in the evolution of man?

2. Most Catholic schools teach evolution as a theory. Is evolution a fact or theory?

3. If evolution is a fact, does it contradict the Bible?

4. Are most anthropologists or men of science agnostic, atheist, or do they believe in God?

I'm really confused and would like the answers to these questions.

(Name withheld.)

Dear Sir:—

You have asked some very difficult questions in your letter. I would have to write a book to give the whole answers, and you would have to do a great deal of studying to understand complete answers or to be able to decide intelligently for yourself. I will try to answer as well as I can in a letter, because I see that you are sincerely interested and because these important questions deserve the best sort of answer that a scientist can give.

1. When the idea that man evolved from a monkey-like animal was first widely discussed, opponents of evolution pointed out that no animal was known that was intermediate between living monkeys or apes and living man. They called this hypothetical intermediate form "the missing link." Since then not only one but a whole series of fossils have been found that are intermediate between modern apes and modern men in their anatomy. Therefore it is quite fair to say that "the missing link" is no longer missing—in fact, several of them are now known.

In another sense, however, it would be possible to agree that there are still "missing links," although this is not now a valid argument against the truth of evolution. If man evolved from a monkey-like ancestor, as I and most scientists are sure is true, then there was probably through the ages a whole series of creatures, starting with one that was wholly monkey-like and leading up to man through thousands of steps, each a little bit more manlike than the last. It is only by a rather unusual accident that such creatures are buried, become fossilized, and then are found again by us. The chances of ever finding every single one of those thousands of steps are practically nil. But some of them have been found and they show that the series did exist even though there is no real hope of finding every last step in it.

2. Whether evolution is a fact or a theory depends on what you mean by "fact" and by "theory." Scientists and non-scientists use the words in different ways. A scientist often calls an explanation a "theory" when a non-scientist would call it a "fact," so that they do not always understand each other very well. Someone who is not a scientist is likely to mean "guess" when he says "theory." To a scientist, a theory is not guesswork but is an explanation of a set of facts. Theories in science may be more or less firmly established. If a scientific theory explains only a few facts and there is doubt as to how others would fit in, then it is not considered well-established. If, however, it explains thousands of known facts and scientists have looked for opposing facts and have not found any that do not fit in, then it becomes a firmly established theory and is generally accepted as true among those who have made a real study of the matter. Speaking in anything except super-cautious scientific language, this sort of theory would be called a fact by almost anyone who understood it. Evolution is in this class. To the scientists who study it, it is a theory, thoroughly established and accepted as true. In popular speech it is a fact.

3. Whether evolution contradicts the Bible also depends on definition. Some people maintain that every word in the Bible was meant to be taken in the most literal sense. For instance, they claim that the word "day" in Genesis means precisely 24 hours, no more and no less. If you take this view, then evolution does contradict the Bible, or the Bible contradicts evolution, whichever way you want to put it. Other devout students of the Bible believe, on the other hand, that parts of it are figurative or poetic, especially those parts that have to do with the creation of the world, animals, and man, and such subjects now studied by

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scientific methods. They say that the Bible was not meant to be a treatise on science and it would not have been understood if it were, because science was primitive when the Bible was written. If you look in the dictionary you will see that "day" can mean either "twenty-four hours" or "a time or period, an age." These Bible students say that "day" in Genesis has this second meaning, not the first. If you interpret the Bible in this way, then evolution does not contradict the Bible. I would prefer to express this differently and to say that modern scientific knowledge, including evolution, shows that the Bible should not be given the most literal interpretation at all points.

4. Some scientists are agnostics or atheists, just as some business men or some mechanics are agnostics or atheists. Scientists may have more tendency to be agnostics, because they are used to questioning evidence and not taking too much on faith, but I am not sure that there would be a larger proportion of agnostics among scientists if we really knew what people believe in their hearts. I do know that many outstanding scientists believe in God. I think that most scientists are religious, in some sense of the word. Many of them who are really deeply religious cannot subscribe to the narrow dogmas taught in some churches. A scientist who believes in evolution and also in God is naturally likely to rebel against a church that teaches that belief in evolution is sacrilegious.

* * *

SIRS:

Several times last winter just before heavy snows I noticed that the birds, the juncos in particular, would congregate in the yard to fill up on the grain we supplied (about 40 pounds during the entire winter). It seemed that the birds almost knew when bad weather was coming. After I had noticed this rather superficially, I watched more carefully and saw the same thing happen before the next two snows. . . . I can't help wondering whether they do not have an extra sense, or some way of telling what the weather is going to do.

MRS. CHARLES M. KENNEDY.
Harrisburg, Pa.

Gladys Diesing photo

EUCALYPTUS: a tree that sheds its bark but not its leaves—at least not all at once. The eucalypts were brought from Australia to the United States to be exploited for their oil and hardwood, but they are now grown for shade and ornamental purposes in many parts of California

The following comments are offered by Dr. John T. Zimmer of the American Museum's Department of Birds:

Birds have no "weather sense" that has ever been proved. Unusual activity preceding storms is due, I suspect, to a decrease in daylight which may give the birds a false impression of oncoming evening, with a consequent tendency to "get filled up" before bedtime. The same sort of increased activity has been observed during eclipses of the sun.

If birds had an accurate sense of impending storms as such, they probably would seek shelter in advance and would not be caught away from it as many of them are. But a good piece of work could be done by anyone who would keep a careful record of exact weather conditions, including apparent diminution of light, and the attendant variation in the activity of birds. There is sure to be a correlation that would be worth investigating.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

Some insects react in the same manner. Perhaps readers have noticed how *Stomoxys*, the stable fly, ordinarily particularly obnoxious in the evening, becomes troublesome before storms.

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EXPLORATIONS

Rutherfurd African Expedition

Since the last issue of NATURAL HISTORY Magazine went to press, the Rutherfurd African Expedition set out on a journey of at least 10,000 miles through the length and breadth of Africa's mountain and jungle regions for the American Museum of Natural History. The expedition will travel by jeep and supply truck from Capetown to Cairo, making numerous side trips into the Kalahari Desert, Tanganyika, Kenya, Uganda, the Belgian Congo, Egyptian Sudan, and Lybian Desert.

Leader of the expedition is Mr. Hugo Rutherfurd, recently Captain in the United States Army. He is accompanied by his wife and Mr. T. Donald Carter, Assistant Curator of the Museum's Department of Mammals, who has made three previous expeditions to Africa. The expedition will be in the field for about one year.

Certain specimens needed by the Museum to round out its study collections of African mammals are being sought, but the principal objective of the expedition is to make extensive technicolor motion pictures and "still" photographic records of African natives and wildlife for educational purposes.

Mr. Rutherfurd, an experienced motion picture cameraman, plans to photograph scenes of native life in many African communities which can be used in various levels of curricula from elementary grades through college studies in anthropology. His cameras will be aimed toward those subjects which have become increasingly important to educators as visual teaching aids on the customs peculiar to various African tribes, as well as the family relationships and events of daily life, their foods and cookery, clothing, agriculture, housing, hunting, trade, music, dance, and crafts.

Wherever possible photographs of living wild animals will be made from "blinds" near waterholes or other hidden spots where animals congregate. Incidents of the expedition's camp life and activities during the year's journey will also be filmed.

Viru Valley Project

Mr. Junius B. Bird, Assistant Curator of Archaeology at the American Museum, also left in May en route for Peru to search for evidence of non-agricultural people who lived some thousands of years ago in a valley near present-day Trujillo. Mr. Bird has joined several scientists from various other institutions, co-operating in the Viru Valley Project of the Institute of Andean Research.

This is the first time that a concerted effort has been made to work out the full cultural history of a Peruvian valley. It is expected that co-ordination of geographical, archaeological, and ethnosociological data will result in a broad study of culture change and adaptation in one of the most aboriginal culture centers of the New World.

Other archaeologists of the expedition already in the field include Dr. William Duncan Strong of Columbia University, who is concentrating on the chronology of the ceramics available at many sites, and Dr. Wendell C. Bennett of Yale University, who will make a study of the architectural features of the ancient adobe structures in the valley. Dr. Gordon R. Wiley of the Smithsonian Institution is making a survey of present-day land utilization for an estimate of former populations. Mr. Andrew Dingwall joined the expedition in June.

Mr. Bird will search for remains of the earliest pre-pottery cultures never before found in Peru in sheltered beach areas where ancient fishing communities may have had their camps.

Each specialist will cover his own particular section of the 20-mile valley, but a common field laboratory will be the focal point for discussion and interchange of ideas as the year's work progresses. Several jeeps will be in use to transport workers and equipment.

Mr. Bird is accompanied by his wife and three small sons, Robert 8, Henry 6, and Thomas 1½ years of age. Making a home in remote, sometimes uninhabited places is not unknown to Mrs. Bird, who has accompanied her husband on several expeditions with their children, the last to the desert region of Chile, where Mr. Bird discovered remains of prehistoric fishermen.

The expedition will be joined early in the fall by Dr. J. W. Jobling, former professor of pathology at the Presbyterian Medical Center. Dr. Jobling will study the mummified human remains for possible traces of disease.

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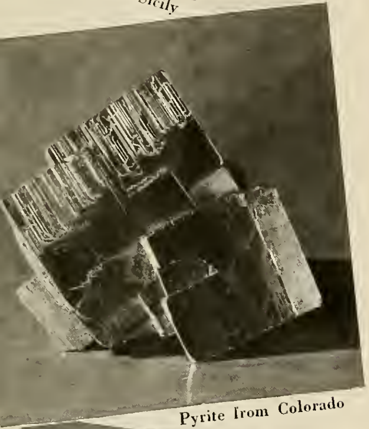

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LETTERS

Sirs:

I was very interested to see the Kodachrome picture of the banana bud on the cover of your September issue.

In addition to the information you gave about the banana tree, some of your readers may also be interested to hear that this bud or blossom is edible and very tasty when cooked in a stew with some kind of meat. Many of the natives in the Philippines use it for food, especially in regions where the banana tree is very plentiful.

Another interesting note is that once the banana tree has produced a stalk of bananas, that tree will not produce any more. The tree is always cut down when the bananas are gathered, and as the root is perennial, the tree will then grow back again in about a year, producing another stalk of bananas. In the Philippines alone there are about 35 different varieties of bananas.

Donald H. Wills.

Freeport, New York

* * *

Sirs:

I have noted with interest the letter of C. P. Fox (September Natural History) and the accompanying picture showing two deformed oaks. In this instance, I think there is a simpler explanation than that the trees were bent by Indians as trail-markers. Early settlers often hacked young trees and bent them over to form a fence or hedgerow. This picture shows a bank in the foreground and a wire fence in the background. Apparently a hedgerow was formed along a roadway, and at a much later date a wire fence was built along the same road.

I first noticed this condition while working in central Long Island some 40 years ago. There a ditch had been dug and the hedgerow formed along the top of the bank, the combination forming a more effective fence. As new branches grew up they had been hacked and looped over again. In some cases this had happened two or three times and had produced some fantastic forms. Trees vary in their resistance to such treatment. Some die in a short time. The oaks seem to recover and continue to grow better than any of the others.

O. L. Ayrs.

Birmingham, Alabama

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $2.00 each, with full credit to the photographer. Return postage must be included.

Sirs:

. . . This writer is convinced that those trees were the work of some early settlers—not Indians—who cut trees to make what we of eastern Long Island call a lop fence. This was made by cutting the tree half-way through and then binding it over in the direction the fence was to run, this process continuing around the field to be inclosed. Remains of these fences are still in existence here.

To make a lop fence that would turn horses, cattle, and sheep required real skill with both mind and ax, and the writer well remembers several experts, one of whom—it was said—could make a fence that even a quail could not go through. And I might add that there were no strings or binders used in construction.

Morgan Topping.

Wainscott, L. I., N. Y.

* * *

Sirs:

Can snakes sing or make gobbling sounds like a turkey? In one of our national magazines I recently read an eyewitness account of a large bull snake that raised its head and gave out a strong melodious trill like that of a meadow lark. I would very much like to hear what an expert has to say about this.

Robert G. Worman.

Linden, N. J.

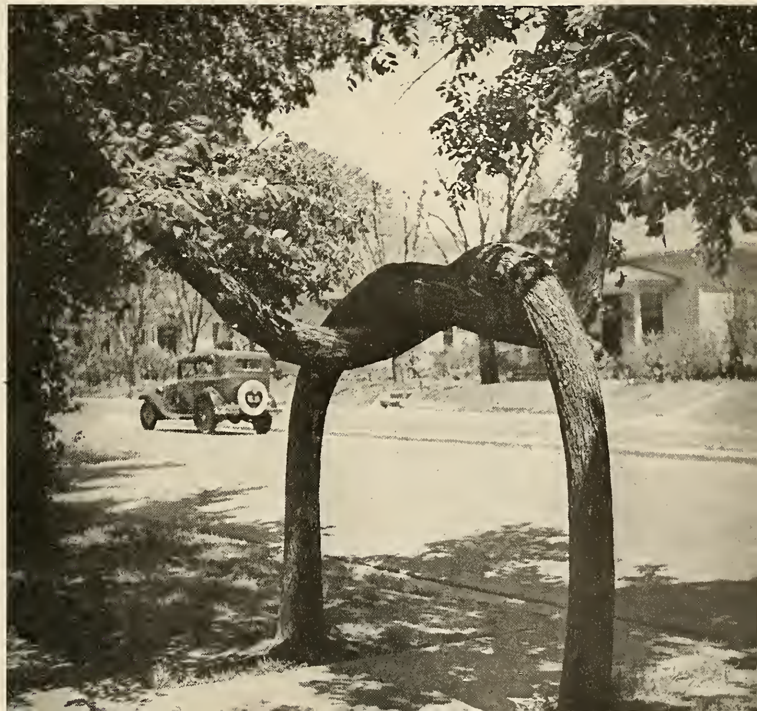
All sorts of noises have been attributed to snakes, and few species are entirely silent. The vast majority are able to hiss, and the sound produced by the rattlesnake is too well known to warrant description. A good many harmless snakes produce a similar "rattling" by vibrating their tails on dead leaves.

One of the more amazing methods of sound production is that employed by the saw-scaled viper of Asia and Africa. This snake inflates the body and, by rubbing one portion of its scale-covered body against another, produces an unusually loud rustling sound.

However, the nearest approach to vocalization among snakes is the sound produced by the American bull snakes (*Pituophis*). A special membrane in the throat, part of the epiglottis, is struck by the jet of air forcibly expelled from the lungs in such a manner that an exceptionally loud hiss is produced, and sometimes a loud staccato noise results. An infuriated bull snake may have the mouth

Continued on page 390

"Just as the twig is bent . . ." These trees were twisted together twelve years ago. This unusual sight was photographed in Shawnee, Oklahoma, by Dean Burch



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WALTER S. GIFFORD

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Frederick Trubee Davison, President — Albert E. Parr, Director

VOLUME LV—No. 8 — OCTOBER, 1946

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THE COVER THIS MONTH

THE SAMOAN KINGFISHER

We think of kingfishers as birds of the water's edge which feed on fish and other aquatic animals. This is true for the American and European kingfishers but not for many of their tropical relatives. The Samoan Kingfisher (*Halcyon recurvirostris*), for example, which is shown on the cover of this issue of Natural History, is never found at the edge of the water, and it lives on insects. It either catches them in the air like a flycatcher or pounces down on them like a shrike. Occasionally it also takes a lizard or small snake, and it has been accused of killing newborn chicks.

This bird is seen in the forest, in native gardens, or in coconut plantations. The nest is in a hollow, either in a decaying tree trunk or in the nest of tree termites. Its eggs are white as in all kingfishers. The call notes of the Samoan species are noisy, rattling, and often repeated. All the kingfishers can be recognized by their upright posture and by their habit of sitting motionless on an exposed perch (dead branch of a tree, post, or telephone wire). New Guinea is the center of the range of the kingfisher family, and more different kinds are found on that island than in any other part of the world.

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YOUR NEW BOOKS

FUR SEALS • DRIFTWOOD VALLEY • BRITAIN'S TREES
JUNGLE IN THE CLOUDS • SCIENCE IN A CHANGING WORLD

DRIFTWOOD VALLEY

- - - by Theodora C. Stanwell-Fletcher

Atlantic, Little, Brown & Company, $4, 384 pages, 22 illustrations and a map.

TWO young people set out to find the land of their dreams somewhere in the unmapped realm of British Columbia—a place unmarred by the inroads of civilization where daily living is an adventure in itself. They found this Eden on the shores of Tetana Lake in the Valley of Driftwood, more than two hundred miles from the nearest outpost. Here they built their snug log cabin and spent two eventful years. With moral fortitude and courage, they braved together the changing seasons of Canada's Northwest, catching the enchantment of the wilderness with its background of mountains, lakes, trees, and untamed creatures portrayed in this engrossing book.

Theodora's first impression of Tetana Lake shows a sympathetic understanding of the Northwest which gleams throughout the pages of her work—"The afternoon sun lay across the still surface of a small, shallow, crystal-clear, vividly colored lake. The water reflected the fantastic mountains of the Frypans, now far to the south, and the bare rugged tops of the Driftwood Range rising beyond the western shore. The winding shores were covered with dense luxuriant sprucewoods. Clumps of poplars, dressed in autumn gold, were scattered on hills and banks. Small marshes on the east and west, which hinted darkly of mosquitoes, added touches of red-brown and yellow. A little "brush wolf," or coyote, stared at us from a high bank, and vanished. Wild ducks and muskrats swimming out from shore split in two the mirrored forests and mountains. At the moment it all looked peaceful and pleasant rather than spectacularly beautiful."

In this amazing story there are other colorful descriptions of the northern country, introductions to its native inhabitants, and accurate accounts of drastic seasonal changes. The careful observations and sketches from life by John F. Stanwell-Fletcher greatly enhance the value of this volume. As with all seriously-minded young people, the Stanwell-Fletchers had a definite mission. Their objective was to make a study, and bring out a representative collection, of the fauna and flora of that region for the Provincial Museum at Victoria. Lists of plants and animals found in the Driftwood Region will be found in the appendix.

GEORGE G. GOODWIN.

TREES IN BRITAIN

- - - - - - - by L. J. F. Brimble

The Cambridge Press, London, Macmillan, New York, $4.50, 352 pp., 183 illust.

COMPARED with northeastern United States, Great Britain has very few native trees, and it is only natural that most of the species treated in this attractive book are introduced or cultivated. This is a painless way of acquiring a knowledge of British trees and the way they appear in the landscape. Though few trees of eastern United States grow well in Britain, and they are hard to identify even at close range, the tulip tree is "outstanding"; and from among the numerous photographs, the bald cypress appears less changed than any other. Our stately southern magnolia is a climber—like wisteria—adorning the walls at Cambridge. On the other hand, trees of the Pacific Coast, being accustomed to a foggy climate, thrive well—redwoods, Douglas fir, Lawson cypress, and arbor-vitae—as does also the Chilean Araucaria, likewise accustomed to a fog climate.

Botanically the book will appear stodgy and not too accurate. The families in which the trees are presented are unconventional, and there are some tenuous arguments about common names. But the author's genius displays itself in folklore, history of plantings, and those bits of information interesting to the gardener, landscaper, historian, and general reader, who will pick up easily a surprising assemblage of fact and fancy. Winter twigs and buds are illustrated in a series of 48 figures. Perhaps the outstanding feature lies in Lonsdale Rugg's beautiful drawings of trees, which alone make the book well worth having. Another feature is the profuse inclusion of fragments of poetry about trees, a sort of arboreal anthology, from the Bible to the present day. All in all, it is a delightful book.

H. K. SVENSON.

SCIENCE IN A CHANGING WORLD (Sixth Edition)

- by E. J. Cable, R. W. Getchell, and W. H. Kadesch

Prentice-Hall, $5.00, 622 pp., 349 illust.

A COMMON custom among authors has been to decide what subject they wish to write about, then develop an outline and proceed with the book. In this instance, the availability of rather mediocre photographs drawn chiefly from industrial sources seems to have dictated the territory. There are few scientific fields into which the authors have not excursioned.

Among the subjects of the 43 chapters will be found a description of the beginnings of science and a listing of the units of measurement, with a well-emphasized plea for the acceptance of a logical decimal series by the American people. Following this is an account of some of man's machines. Physics and the structure of matter, chemistry, and energy are well described. It is a good attempt to show the relationships among these sciences, and this is particularly timely now because of the recent developments in atomic disintegration. One is surprised that more information on the latter subject is not given in a book touching on this field nearly a year after the release of the Smyth report and the declassification of much of the later research.

Several chapters deal with the atmosphere and weather, and another set is devoted to light and light phenomena. Electricity and water are discussed in the concluding chapters, along with a few of the elements (two of them with good commercial backing; sulphur and carbon). One then looks in vain for the tieing-in of all the sciences promised in the introduction.

At best, we can say that this is a useful compendium of knowledge, executed with moderate care. One wonders for whom the book is intended. It

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cannot be read as light reading, and for real information one would go to more specialized texts. Inaccuracies are probably not rare, judging by the treatment of geology, in which this reviewer is best versed. The description and diagram of a batholith is novel, to say the least, and the use of the word "lead" when "galena" is meant may trouble many who are not economic geologists. Silicon dioxide is principally quartz, and one would not include sand as a special variety of the compound; and it's stretching a mineralologist's patience to include agate, onyx, jasper, and flint—all varieties of quartz—for that is giving species status to varietal terms.

F. H. Pough.

THE HUNTING OF THE SILVER FLEECE

Epic of the Fur Seal

- - - - - - by Fredericka Martin

Greenberg, $4.00,
328 pp., 24 illustrations

THE tragic story of sealing, from the discovery of sea lions and fur seals to the present day, is told by Mrs. Martin with a student's attention to detail and with an almost poetic intensity and sympathy. It reveals the incredible greed and corruption and the cruelty to man and beast that resulted from this "found wealth." Friendly peoples came perilously close to war and foreshadowed in the last part of the nineteenth century some of the rivalry that lies underneath the diplomatic maneuvering of this troubled postwar period.

Fur seals were known long before their value as fur bearers was recognized, but about 150 years ago the Chinese discovered how to "pluck" the coarse guard hairs, leaving only the silky underfur. English and American furriers soon learned the necessary secrets, and the fate of the "sea bears" was settled. The Russians had discovered and claimed the northern islands where these animals bred, but the southern fur seals inhabited desert islands belonging to no nation or only weakly controlled by minor powers. Sealers, chiefly British and American, visited the southern rookeries, killing without thought of the future. Only a pitiful remnant remains and many of the island species are completely exterminated. While the northern "sea bears" were massacred by millions, the Russians had a vague idea of conservation, and the fur seals were royal property, cropped rather than used up. When modern methods were applied to their conservation they made a marvelous recovery.

The sad fate of the Aleutian people, massacred and enslaved by the Russians and bound almost like serfs to the islands under American guardianship, is discussed at length. It will not do for this country to be unfavorably compared with present-day Russia in regard to dependent peoples in this critical region where the two great countries come so close together.

It is a pity that this valuable book is printed on paper that leaves much to be desired. The story is one that should be read by every lover of Nature and every conscientious citizen.

J. E. Hill.

JUNGLE IN THE CLOUDS

(New Edition)

- by Victor Wolfgang von Hagen

Duell, Sloan and Pearce, $3.75,
269 pp., 59 illust.

SCIENCE and personal adventure are good companions, especially when united in a warm flow of picture-making language and interspersed with history and legend.

Mr. and Mrs. von Hagen went to Honduras primarily to search for the Quetzal, a bird which had never been photographed or exhibited. Sacred bird of the Aztecs, it lent its name to a god, Quetzalcoatl, the Plumed Serpent. Stone-carvings on pre-Columbian temples feature its plumes.

Not even the Aztecs could rear this bird when taken from its lofty rain forests. But the von Hagens tended baby quetzals with success, getting them alive to some of our zoological parks, where, thanks to skillful care, this "most beautiful bird in the world" may be seen.

There are two other main adventures in this well-illustrated book, and a host of lesser ones, condensed into lively reading.

Finding the Jicaque Indians, the "Lost Tribe," led to winning their confidence to the point of being admitted inside their stockades. Even these shy Indians are "helpful and pleasant" like everyone on the von Hagens' path, in town or jungle, through months of travel by foot, plane, mule, train, or bouncing bus.

The visit to Copan, southwesternmost known boundary of the Mayan Old Empire, is described in both factual and poetic language: "So bewitching were the silence and utter beauty of that place that if a priest had walked through the court in his rich robes and tall plumed headdress, I think I should have taken it quite for granted."

Army ants eating up the garden, a sloth which is fearsome terror to superstitious natives, moths with an 11-inch wingspread, howling monkeys, lead up to the dramatic fight with the serpent of old legend: "I had lived the ancient myth . . . I had captured the Quetzal and killed the snake."

Grace E. Barstow Murphy.

Cow's Tongue Cactus

By Jewell Casey

All photographs by the author

TO the average person the word "cactus" calls to mind the prickly pear (*Opuntia*), and this is not so strange since there are more than one hundred different varieties of this particular cactus in America. But the *Cow's Tongue Cactus* (*Opuntia linguiformis*) is a very rare species.

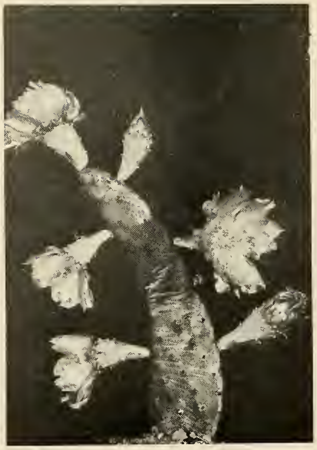
Almost 40 years ago David Griffiths discovered this odd cactus, growing in small quantities in the immediate vicinity of San Antonio, Texas. And as far as is known, it does not grow wild anywhere else in the world. Mr. Griffiths first described the Cow's Tongue, or Lengua de Vaca, in the Annual Report of the Missouri Botanical Garden for 1908.

This oddity does not spread as rapidly as other opuntias and is held down because of a black fungus that destroys many of the plants. Another reason for its not being more plentiful in its natural habitat is that cactus collectors have almost exterminated it.

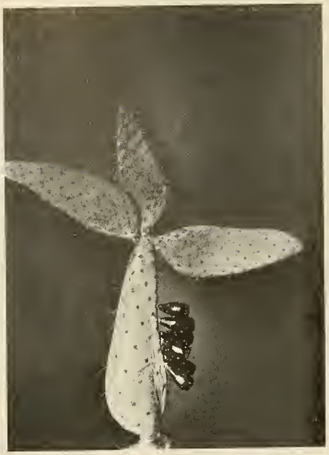
The outstanding characteristic of this cactus is the shape of the pads, which taper off not unlike the tongue of a cow. It is quite common for pads to reach a length of three to four feet, with a width of only three or four inches. Such size is attained during the growing period from late spring to early fall. When the long pads die and fall to the ground, the flesh and skin soon rot away, leaving a tough fiber network. This is of a rich ivory hue and resembles the most delicate lace design imaginable.

The Cow's Tongue Cactus does exceptionally well in cultivation where the soil is rich and water plentiful. It grows rapidly into bushy plants and forms a most formidable hedge, one not easily penetrated by either man or beast.

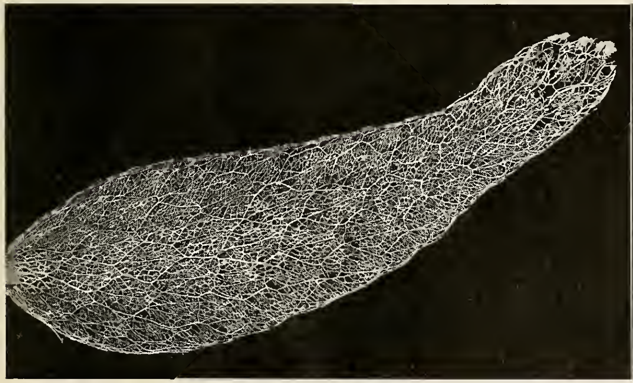
While undoubtedly a native of south Texas where winters are very mild, the Cow's Tongue will stand cold weather and is common in cultivated cactus gardens.



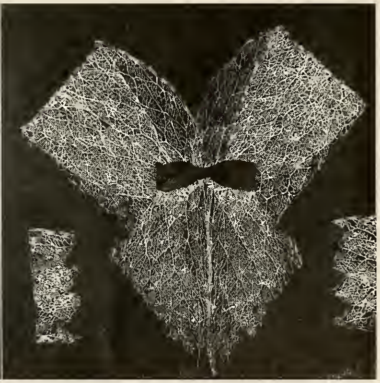
THE COW'S TONGUE CACTUS produces few blossoms. However when they do appear, the flowers are very large and beautiful—silky textured and bright yellow with orange centers. They are attractive to bees and other nectar-seeking insects and birds



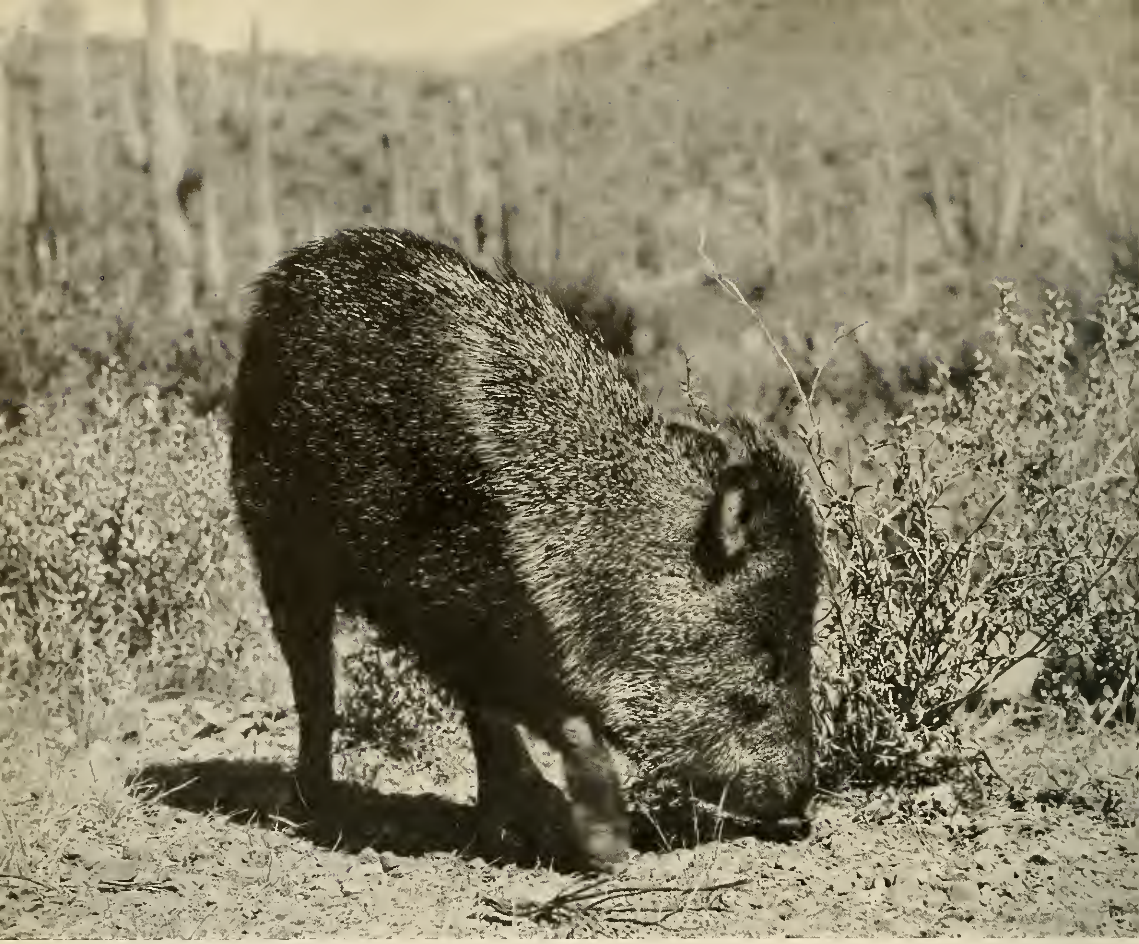
FRUIT seldom sets on this cactus, which, therefore, depends almost entirely upon pad distribution for perpetuation. In shape, size, and color (rich reddish-purple), the well-seeded fruits, shown here, are similar to those produced by other opuntias



WHEN THE FLESH AND SKIN rot away from the pads, the fiber skeletons that remain look like ivory-colored lace



A COLLAR AND CUFF SET made of the cactus fairy "lace"



▲ ADULT WILD PECCARY: an animal seldom photographed. A twelve-inch lens caught Blackie in various typical poses as he applied his nose to the desert floor. His ears were constantly in motion like those of a deer. He was a compact bundle of muscle and sinew

By WILLIAM H. CARR

Photographs by MARVIN H. FROST

FOR nearly a year I had traveled over the desert areas of Arizona, always hoping to catch at least a glimpse of the much talked of, but little known, peccary, or javelina—the so-called "Wild Pig" of the Southwest border country. The Mexicans speak of the small animal as "The creature that sees but is unseen." They pronounce his name, "Have-ah-LEENA."

The peccary has inspired some of the wildest hunting tales ever to originate in America. He has been depicted as a fierce, desperate, and cunning enemy of those who stalk him with or without a gun. He is a piglike animal with a stout chest, long head, and powerful hindquarters. He stands some 30 inches high at the shoulder, has an excuse for a tail, weighs as much as 60 pounds, and is about a yard in length.

Many times, in arroyo beds, I came upon peccary tracks so fresh that sand grains were still falling into depressions made by the small hoofs. Actually, I suppose, the animals were often barely out of sight, over a slight rise in the cactus-covered desert, behind a large growth of mesquite, or trotting down a high-banked stream bed. It seemed to me that practically everyone except myself had observed the animals, for they are not at all uncommon in the Southwest desert region.

I had heard so many stories of the ferocity and diabolical behavior of these desert and chaparral wanderers that I never trailed them without some trepidation. Several times I was taken to areas where, only a few hours before, "Wild Pigs" were said to have treed the person who had encountered them, or had driven him pell-mell from the region. On one such spot, while being entertained with the description of my guide's experience in being treed, I looked carefully about and failed to observe a tree

Wild Pigs of the Desert

Curiosity led the author to discover that the peccary, far from being the fierce, cunning beast of his reputation, is normally timid and may even become a pet

within miles. All I could think of was the Indian Rope Trick.

One person told of being charged by 40 peccaries. It seemed that he was hunting in a small box canyon when, as he approached the rear wall, he suddenly spied the whole "herd." An instant later they all "charged" him. He thereupon jumped upon a high rock as the fierce animals went by. When asked whether or not the animals, having no other means of escape, might not have been simply running away, and through necessity had to pass near him, my informant said, "Well, it could have been that way, but they certainly charged me!"

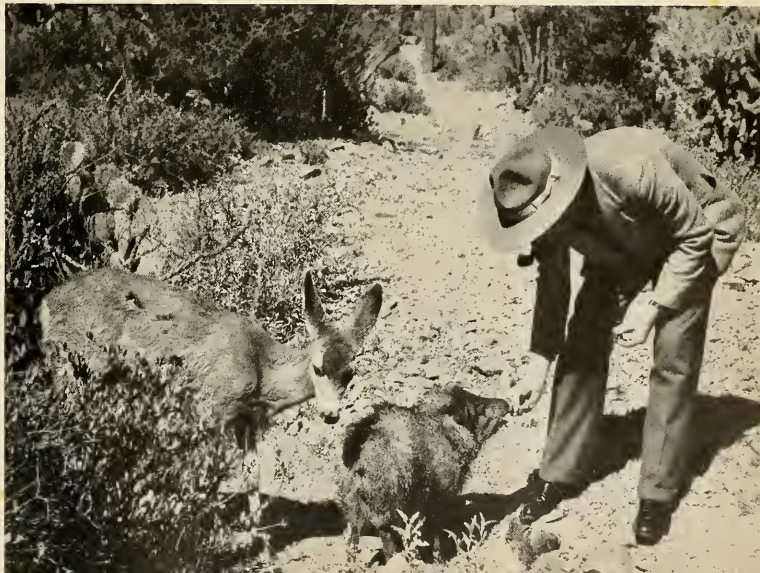
Another intrepid hunter told of being treed by an angry group of the animals. He said that he stayed up in the tree for two hours and that the peccaries looked up at him all the time he remained perched upon a limb of doubtful strength. He later remarked that he didn't believe a peccary's vision would permit it to see more than a few feet. Indeed, the inconsistencies of the various narratives began to suggest that all was not aboveboard.

"Look out whenever you come upon a mother peccary with young ones!" said one acquaintance. "They'll charge you sure!" The next day another friend told of seeing a baby peccary near the road. He stated that he had stopped his car, pursued the infant, and caught it. While he held the little pig it "squalled and yelled bloody-murder!" During the process, the mother came into view some 50 feet away. She stood there belligerently and "champed" her teeth. However, she made no attempt to charge. The man who told me of this experience said that he released the small animal after examining it and walked back to his car. Among other things, no one had told him how dangerous peccaries were! "A very unusual experience," my hunter friends called it. Perhaps it was. I had yet even to see a javelina.

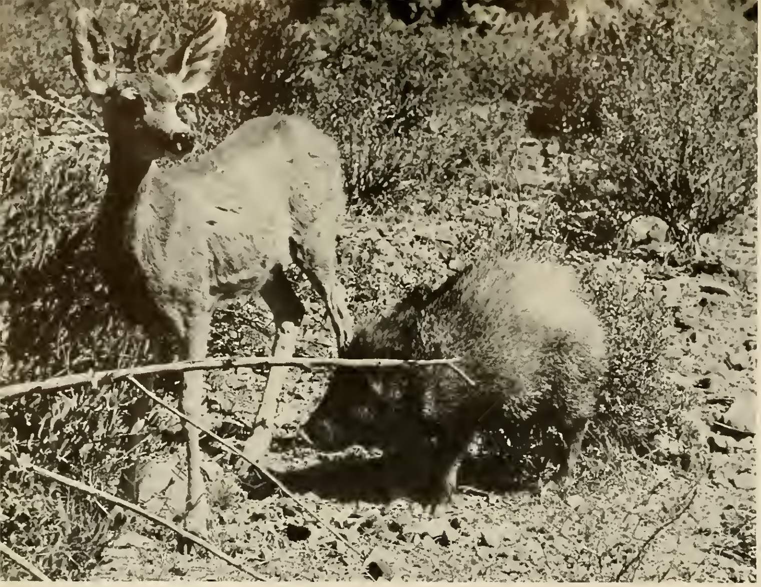
I once visited a woman who owned a large estate on the outskirts of Tucson, Arizona. An account in the local paper about her experiences with peccaries indicated that she had actually been trapped in her house by a group of them. The animals made frequent and unwanted visits to her bird baths and charged any human who ventured to approach. The woman said she had appealed to the local authorities to rescue her in some way. When I arrived, I found her in a high state of excitement. The State Game Warden had been there a short time before and had refused to have any part in killing the peccaries. He warned the woman that the hunting season had not opened and that he would take into custody anyone who shot the animals. He further declared that if someone were to shout *"boo"* at the animals, they would run away! All of this had totally failed to reassure the estate owner, who was only too well acquainted with the type of fearsome peccary stories that make stout hearts quail.

We investigated the neighboring mesquite groves and found many places—quite near the main house, too—where peccaries had bedded down in the shade. Their tracks were everywhere—but no peccaries. I was disappointed again, but fate was not to be against me eternally.

One day, while engaged in a house cleaning project, I received a welcome caller, the Reverend



➤THIS DEER AND PECCARY fed and slept together. They greeted visitors without fear of human attack. The seemingly odd association reminded a rancher that he had once seen range cattle and peccaries feeding together



◄It was strange to see the ill-assorted pair appear from behind a desert plant. They were inseparable. The peccary often ran right under the mule deer

Carl H. Elmore, of Englewood, New Jersey. He had a keen liking for the desert and the mountain country surrounding Tucson, and frequently went abroad to see what he could see. He had heard about peccaries in a vague sort of way, and on the preceding week-end had visited the wild country. He had been pleased but not particularly surprised to observe a group of about 18 of the animals feeding not far from the roadside. He stopped his automobile for a while and watched them, and then, with his wife, strolled down the road toward the busy pigs. Presently, a small animal came over to him and "snuffled at his trouser leg." The gentleman remembered that he had some peanuts in his pocket and offered a few of them to the exploring piglet. They were accepted with alacrity, and all went well. As Dr. Elmore remarked, "I was not a bit afraid of them, and they didn't make any trouble at all. I stood and watched them as long as I pleased and then got back into the car and drove away. As I went, a very large, black fellow, chewing upon a piece of prickly pear cactus, looked up at me and kept right on eating. I really had more interest in him than he exhibited in me. Peccaries? Why certainly I've seen them!"

When I showed excitement over Dr. Elmore's adventure and explained that I had sought the animals for months, he was surprised. He carefully described the exact spot where he had encountered them, and I made plans to visit the region as soon as possible.

Several days later, my indefatigable photographer-naturalist companion, Marvin H. Frost, and I set out for the region where the peccary had "snuffled" at the Reverend's trouser leg. We were to find luck beyond our fondest dreams. The place was almost in the center of a picturesque mountain-desert region about 25 miles south of Tucson. The cactus growths stretched out for many miles, and exceedingly sharp-peaked mountains ringed the region.

But first we called upon Joseph Carruthers, who lived in the desert. He had a very young, orphaned peccary, brought to him by the Game Warden who was desirous of having the infant raised and released. Joe had worked long and hard to tame this little pig, but it was still pugnacious and did not welcome strangers. Near-by was another young javelina, kept as a pet under conditions of perfect freedom. He was about half grown and was as tame as could be. One of his principal objectives in life was to remain in the area where cars parked and beg for food from the few visitors who happened along. Unlike the somewhat aggressive little one, the truly docile animal was a favorite with many people. He would approach parked automobiles and sniff about until someone shared a sandwich or some fruit with him. He would gobble the food and come back for more. When filled to repletion, the placid little animal would wander off to the shelter of a large paloverde tree, paw the loose sand, and then lie down for a siesta.

I scratched its back and fed it with an apple, and after watching it for a time I began to have the idea that some of my friends had been pulling my leg with their stories of the fierceness of the peccary. I did notice, however, that whenever I strolled toward the sheltering paloverde tree, and the javelina stirred from its slumbers to the point of recognizing my presence, its hackles would instantly stand erect. As I became familiar with the animal and visited it on other occasions, it would duplicate the hair-raising performance whenever I encountered it suddenly.

The javelina had a companion—a gentle, half-grown desert Mule Deer. The deer had also been a family pet before being given its freedom. Both animals, ill-assorted pair that they seemed, had hundreds of miles of desert in which to roam if they so desired. Not many miles off, the arid country extended straight into Mexico and far away. The relationship between the two was not as far fetched, according to scientific classification, as first sight might have suggested. The little pig was not many steps removed from being a close relative of the deer. Peccaries and deer belong to the same scientific order, both being known as "even-toed, hoofed mammals."

Regardless of this more or less technical kinship, it certainly did

➤ Piglet—A very young peccary, bottle-fed and very tame. It would follow one about as though it were a puppy

seem strange to see the two dissimilar companions as they appeared from behind some large desert plant and approached to discover what was in store for them in the way of food. The deer was as big a beggar as his friend, if not more so, for, thanks to his superior height, he could and did reach into one's pocket, as tame deer are wont to do. The peccary, meanwhile, could do no more than make tentative nibbles at one's trouser legs as he waited impatiently for a handout.

The little pig would sometimes take the shortest course between two points, and this often led him to cross between the deer's hind and front legs. The deer, meantime, paid not the slightest attention. On one occasion we followed along as the two animals, having fed well, walked together down the path. Once more the peccary scraped the ground with his forefeet, preparatory to making as cool and fresh a bed as possible. He had not completed this task before the young deer stepped upon the same spot, gave a few digs of his own, and promptly lay down in the spot where the peccary obviously had intended to lie. The pig took the invasion in his stride and scraped a new section of ground near-by. Then he, too, lay down, his body touching that of the reclining deer. They went to sleep in this fashion, and we walked away to leave them undisturbed.

At various times I had been told that the young of the peccary were reddish in color, being quite unlike the adults. Persons to whom I had talked, who had captured and raised the little wild pigs, stated that the ones they had cared for had been grayish with a light, straw-colored cast in the coarse hairs. Indeed, the ones I saw were colored in this manner, though it was easy to imagine that a reddish shade could sometimes replace the yellow. Dr. E. A. Mearns, a pioneer naturalist in the more easterly javelina country, reported reddish young and wrote that the infants retained their carrot-colored hue until they were nearly full-grown. Not so the half-grown individual with which I became familiar. He was a light gray from stem to stern, with a light sprinkling of whitish hairs about his neck and undersides and a darker streak along his back.

Persons seem surprised to learn that the peccary is not even closely related to the domestic pig. The domestic pig has large litters, but the peccary is believed to average only two in each litter. On this point my informants agreed. I also learned that when a young one was chased and caught, its brother or

Continued on page 392

➤ "Blackie," the full-grown wild peccary, fraternized with his civilized cousin. The younger animal, which had gray hair, did not seem particularly interested in its dark visitor

Photos courtesy Archbold Expedition

NOT A NATIVE VILLAGE, but the headquarters of a scientific expedition in the interior of New Guinea: an example of large-scale operations in scientific exploration. The photograph at left, also taken on one of the Archbold New Guinea expeditions, shows how many people were needed simply to load the huge seaplane that served to transport men and equipment

IN the years between the wars newspaper readers frequently came upon such headlines as "Lost World Discovered," "Stone Age Still Exists," "Museum Expedition Finds New Guinea Jungle Paradise." Several American Museum expeditions are now already in the field or on the point of departing, so we may hope that before very long similar phrases will once more appear in the press.

Wars breed restlessness, as most of us know, and when the excitement of military service with its roving and uncertain existence, is taken away from a man, he finds it very hard to settle back in the dull harness of a civilian occupation. With the advent of women into an activity once considered the exclusive province of males, it seems reasonable to suppose that the average WAC or WAVE will experience the same feelings as a G.I. or gob. She may find it just as difficult to adjust herself to a less varied and active life as he does.

Sometimes an ex-soldier strays into the Museum and breathes again the air of far countries. He wonders, perhaps, who has collected the groups and specimens that he sees; he feels that maybe he is qualified through his recent hazardous career to join in the collecting of such things. But he does not know what qualifications the museum collector must have, nor does he know the tremendous amount of detail that must be worked out before the collector and his expedition can even start out on their journey.

The picture that headlines like those caused to float before my eyes when they were young was of the hardy, bronzed explorer leaning on his rifle and gazing from a mountain peak over a limitless expanse of country, while his faithful Indians rested and refreshed themselves. It never occurred to me that if the hardy explorer did not have a third eye in the back of his head resting constantly on the same faithful Indians, they would have decamped with all his equipment and lived happily for the rest of their lives. Neither did I realize that in addition to his rifle, he must have

So You Want to go *EXPLORING*

Like any other scientific profession, exploring requires a keen mind, plenty of resourcefulness, and highly specialized training—but there is always room at the top

By Geoffrey M. Tate

Staff Member, Archbold Expeditions, American Museum of Natural History

A.M.N.H. photo courtesy T. Donald Carter

▲ This is just as much the headquarters of an expedition as the "village" at the left. Three men and a dog made up this exploring party on top of mysterious Mt. Roraima in the Venezuelan wilderness, but widely diversified scientific investigations were pursued

had such things as dental forceps to extract his aching teeth, rat and mouse traps with which to catch his specimens, a few hundred pounds of old newspapers to wrap them in, loose-leaf binders for his notes, pencils to write the notes, spools of thread, soap, bath towels, cameras and photographic equipment, trade goods, and hundreds of other things. Very likely, on top of all that, he was carrying dress clothes and wondering where he would get a clean collar in a few weeks, particularly if he was in British Colonial territory.

The man himself—well, probably he was a Ph.D or an M.A. at least and had earned his degrees by studying at night while carrying on some very prosaic occupation during the day. He had shown unusual interest in natural history and its related subjects from his youth on and finally, after studying in many universities, had become a world authority on such humble subjects as snails or squirrels. Lions did not interest him particularly; after all there are only two or three kinds of lions. But rats, ah, there you really have something. Would you believe that there are perhaps a thousand different kinds of rats? An acquaintance of mine, during his training period for the First World War, used to spend his off-duty moments painting trees with beer, to attract butterflies and moths. Such flagrant misuse of beer brought him into disrepute with the whole regiment, of course, but he could not help that; he was following his destiny, and now his name is known to mammalogists all over the world. Well, that's the sort of man he was—trained to search for the minutiae but at the same time not to overlook the obvious. Let's leave him on his mountain peak for a while and go behind the scenes to consider how and why he got there.

He has one or two fellow scientists with him, and their expedition is one of three main types. It may be a large-scale thing where money is no object. Probably in that case it includes an airplane or flying boat, quantities of radio gear, food in many delectable forms, first-class passages on luxury liners, warehouses built in which to keep his stores, native labor arranged for in advance, everything of the best and most expensive. Or it may be a medium-size affair, not running to a plane but nevertheless done under very comfortable conditions. In this case, though, finances are more closely watched and very likely, in place of a plane, a truck has been provided, assuming that the country can be traveled in that way. Time and trade goods can be saved if other transport than native porters is available. Probably, in this type of expedition, no radio communication is to be kept up, and consequently the cost of operators has been avoided. Food, of course, is plentiful but perhaps not so varied as in the case of the larger expedition. Yet again, it may be a small-scale or catch-as-catch-can sort of expedition. If so, travel is by freighter, river steamer, and other forms of water transport in descending order of merit until finally the explorer and his companions will start out to cover the last hundred miles or so on their big flat feet. Most likely he will be compelled to dump the few small luxuries he starts out with, and later his cot and spare clothing will go, because he does not have enough trade goods to pay porters for carrying more than the bare necessities. His food is limited to rice, farina or some other native fare, a little bacon, and what he can shoot. He will eat a lot of his birds and mammals after he has taken their skins as specimens.

The subject of trade goods alone, if covered in detail, would make up the greater part of an article, but there are certain staples such as red cloth, salt, colored face paints, fishhooks, mirrors, and beads, which have a high value in exchange for labor almost anywhere. Sometimes though, our explorer, if he has a merchandising turn of mind, will take along other things. Cowrie shells, rubber dolls, lipstick, Woolworth jewelry, harmonicas, and machetes all have a labor value in various parts of the world. A gang of natives, full of half-cooked meat and cashiri or some other local hootch, paid off in harmonicas, can produce sounds which no orchestra would attempt to reproduce.

Getting back to our friend again, you may wonder who pays his bills. Well, there are several answers. Museums are usually publicly financed and consequently are almost always short of funds. Sometimes, though rarely, a museum will finance the whole expedition, or two similar institutions will do it jointly, but more frequently the bills are paid either in full or in part by private individuals who are interested in some particular form of natural science. In that case, the individual who is paying has a lot to say about where the expedition will go, how large it will be, and so on. Usually he will go along with it, either as leader, as in the case of Richard Archbold, or perhaps to take part in the collecting of specimens.

But perhaps I should have started with the reason for the expedition. There are still a good many parts of the world about which very little is known, and it is the job of a museum to find out what is there and to tell the public. Slowly museum activities have progressed and gradually the unknown countries have been opened up and their secrets discovered, but in South America, for instance, there are thousands of square miles of territory that have never been scientifically explored. They show on the maps either in white or else are marked "Region little surveyed," and so it is with New Guinea and parts of Asia.

All the various phases of expeditionary affairs up to the point where the men actually commence field work are interrelated. By that I mean that the destination depends on the purpose, the means and methods of getting there depend on the destination, the equipment depends on the purpose, and the costs to a large extent depend on the equipment. There can be no hard and fast rule governing an expedition, neither can it be broken down, departmentalized, graphed or charted as an ordinary business can be. Its function is to gain as much knowledge in one or more branches of natural science as the time and money at its disposal will permit. Consequently as little as possible is left to chance; in the small, or catch-as-catch-can type of expedition, however, there is likely to be a great deal of improvising.

Generally speaking, all members of the expedition are specialists in some form of natural science and experts in more than one. A mammalogist may have to collect birds as well as animals, and a botanist may have to double in herpetology. In the case of the large-scale expedition, where the costs may run into the hundreds of thousands of dollars, there should be a sort of semi-business man. He has to be a combination of banker, purchasing agent, quartermaster, and mess steward. Very likely he also will have the task of engaging and controlling the porters. He will have the responsibility of the stores, and he must be sure that nothing is lost, stolen, or AWOL in any other way. In addition to his diplomatic and financial talents, he must be a competent gang boss, with the drive of an ex-sergeant. The selection of the personnel, the compatibility of the members, is of prime importance. When two or three men live together for months on end, seeing nobody else, they are prone to get on each other's nerves. Small things, little personal habits, assume exaggerated proportions, and more than one expedition has failed to achieve all that it might have done, solely through friction among its members.

Of course, other things may cause the failure of an expedition, and its members are expected to be able to meet and overcome any incidental accidents and disasters. In 1936 some members of an Archbold expedition were about 600 miles up the Fly River in Papua. They had been receiving supplies by plane from their base, and the plane had been taken to Port Moresby for checking. While she was at anchor there, a terrific squall arose and she sank. No commercial plane could be procured, and the field party was marooned with no hope of receiving further supplies. Newspapers in London and other cities carried reports of the men starving to death in the bush, being eaten rather than eating. Hope had been abandoned, to quote the press, when they sailed in on rafts, with complete personnel and collections. One man said that the worst part of it for him was that he had broken his glasses and bumped into a wasps nest, simultaneously. Another member, when I commiserated with him, told me that, far from being bedraggled survivors, they formed a triumphant procession.

The destination of the expedition of course governs to a great degree both the firearms and the type of clothing carried. One would not use a .30-.30 rifle for hunting on Long Island and, as a matter of fact, it is not of much use in Brazil either, though for a different reason. In many parts of Brazil the country is so densely forested that a shotgun is the only means of collecting, other than trapping; one must have a charge that will scatter, rather than a single bullet, and a load of ball or buckshot has plenty of shock-power at short range. On the other hand, to hunt such a creature as an elephant with a shotgun is an unnecessarily elaborate form of attempted suicide. As for clothes, our explorer wears warm clothing in cold places and cool clothes in warm places, just like you and me. Frequently, though, if he should be climbing a mountain, he will be camped in the morning where temperatures run up to 100 degrees but will pitch his tent at night on the mountain side where the thermometer reads about freezing. He must be prepared for both.

A very important part of the explorer's equipment is his medicine chest. He is going to be a long way from the corner drug store, and while he will be profusely inoculated before he leaves, he must carry such things as snake-bite serum, chlorodyne, quinine or atabrine, and a variety of drugs in tablet form. He may have to extract teeth, as nothing is more terrible than to lose a filling and have toothache in the wilderness, and either he or one of his companions may be called upon at any time to play dentist. There are other reasons for carrying some of the more usual remedies; many natives like to be doctored up a bit and some of them take a childish delight in being dabbed with iodine, probably because it gives them an unusually aseptic feeling. The chemical section of his equipment will include some of his collecting gear as well as his personal medications; after taking off a skin he must dust it with powdered arsenic or some similar substance to prevent destruction by insect pests. If he takes a snake or a lizard, probably he will keep it in a can of formaldehyde. A collector friend of mine was instructed to get a group of chimpanzees from the Ivory Coast and another group of mandrills from the Cameroons. The chimps were duly collected and the skins shipped, but by the time the mandrills had been taken, word was received that the chimp skins had been badly preserved and had spoiled. There was nothing else to do but return to the Ivory Coast and re-collect them. Extremely annoying, of course ,but no more difficult than the first time, but for the fact that World War II had started in the meantime. Vichy had taken over the Ivory Coast, and our collector was suspected by the authorities of being a foreign agent. He left the Ivory Coast as fast as possible and finally got his chimps in the neighboring country of Liberia. Ultimately he arrived back in Brooklyn, many pounds lighter and acting in the capacity of a ship's surgeon, after a trip during which he dressed amputations and looked after a crew broken by storms.

Versatility must be a collector's middle name, and if skins spoil, it's apt to be just too bad.

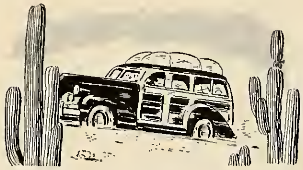
However, the use of chemicals by native personnel must be watched closely. A Peruvian Indian, employed as a bird skinner, once got a slight scratch on his leg. The treatment of skins by chemicals had been explained to him, so what was more natural than that he should treat his own skin in the same way. He bathed the injury with 40% formaldehyde and then dusted it with arsenic to keep the "bichus" away. He nearly burned his leg off.

Each of the natural sciences has its own collecting equipment, and each of the collectors has his own idea as to what it should include. All of it has to be transported somehow to the base camp. The business man, or administrator, should take a good supply of aspirin, for his headaches will be many and severe.

There is still another thing that our explorer must bear in mind—do the people in the country to which he is going want him, and to what terms and conditions must he conform? With Peace still partly undeclared, those considerations at the present are perhaps a little distorted. Generally he is acceptable in most places, but there is a tremendous amount of documentation about it. Of course, he has his passport and must get a visa for the country to which he is going, but also he must get visas for all the countries through which he passes before he gets there. He must provide himself with certificates proving immunization from various diseases; sometimes he must have a document from his local Chief of Police, certifying that he is a nice sort of chap and has no criminal record. A friend of mine, also a member of Archbold Expeditions, who is about to go out into the field has had to be immunized against typhoid, smallpox, yellow fever, typhus, and para-typhoid, and right now he feels as though he had them all.

When our expeditioner gets so far into the interior that civil law no longer carries any weight, he must observe scrupulously the native, or as some call them, the savage taboos. His collections will be more satisfactory and his head will rest more firmly on his shoulders if he does.

What he does in the field is quite another story and does not fit into this little essay. I am trying simply to tell about some of the things our explorer must do and some of the equipment, mental as well as physical, he must have, before he even starts out for that mountain peak or that unexplored jungle. I feel, and have tried to convey, that the explorer must be born. He is in that business because, primarily, he cannot and will not be in any other and is willing to go through the monotonous years of preparation in order to achieve eminence. Secondarily, new explorers will win distinction in the coming years, of course, provided that unquenchable spark is in them, but they will be the ones who prepare themselves most effectively and tirelessly for this exacting profession.



Talking by WHISTLING

How the goatherds of Gomera in the Canary Islands converse at great distances by means of whistled speech

By Annette Gest Very

Photographs, unless otherwise credited, courtesy of the Cabildos of Gomera, Tenerife and Gran Canaria

Victor, a Gomeran, "speaking"

LEGEND has its own version of the origin of the whistled language of Gomera. It tells us that the inhabitants of that Canary Island had come from an African shore where, for some reason or other, they had had their tongues cut out. They had been set adrift in boats without oars and had floated over to the rugged little island. There they landed silently, making out so well without their tongues that before long they had invented a whistled language which, since the days of the conquistadors, has been adapted to a Spanish vocabulary.

This and countless other allusions to an alleged whistled language on Gomera determined us to visit the island and investigate. We would try to arrange a test between two whistlers and prove to our own satisfaction whether the language were myth or fact, and if fact, of what use today in the usual transmission of thought. With a letter to this effect from the Cabildo Insular, or Government authorities, of Tenerife, to the corresponding office on Gomera, we set sail for the primitive isle.

Although Gomera lies only about twenty miles from Tenerife, the interinsular steamer took a whole night to get there, circumnavigating most of the larger island on the way. We hoped to reach Hermigua, where a giant crane lets down an open basket for passengers and hoists them 60 feet to the top of the forbidding cliff that guards the tiny bay. It seemed as if such a landing might well rival that of the tongueless Guanches, but the waves were even too boisterous for our little steamer to reach the crane, and she made for the quieter waters of San Sebastián. There a small boat came out to get us. Its boatmen had oars, and as to tongues there could be no question, as all of them were wagging at once.

Of the entire population of Gomera, which amounts to about 25,000 persons on an area of 144 square miles, at least one-fifth lives in San Sebastián. We went straight to the *fonda,* for it was breakfast time, and when the waitress saw us entering the dining room she began to whistle frantically. Both my husband and I showed surprise, and she turned to us apologetically. "With your permission, señores," she said, "I am calling my little boy. He's gone off with the goat and you'll want milk with your coffee."

Nothing could have pleased us more than to get this immediate close-up of the language. "It's his name, *Pepe,* that I was whistling," she explained. As a matter of fact, it was the only word she knew how to whistle. Women, she told us, rarely learned because, being at home most of the time, they had little need for long-distance conversations. It is the lonely goatherds on the mountain peaks, seeing each other silhouetted against the sky, who feel the urge to chat in the whistled language. And so, through generations of practice, the whistled Guanche language has become whistled Spanish.

"Watch me," she continued, "I'll say *Pepe* over and over again."

With her lips drawn back in a stiff smile and her teeth clenched, she whistled the name several times, varying the pitch, tone, and timbre in successive attempts to make herself clear. Her lips made no motion to produce the explosive sound of the consonant *p,* yet we

Foto Baena

▲ A TYPICAL MOUNTAIN VIEW in Tenerife. Rough terrain comparable to this forms the background of the whistled conversations of the Gomerans

heard the twin syllables as distinctly as if she had spoken them. The sound could not, however, have been mistaken for ordinary speech, because throughout the many variations it still retained the unmistakable quality of a whistle. It was like the call of a bird. One often hears birds approximating human phrases, like the Gambel's quail of our Southwest who seems to say, "What fine weather!" or the eastern quail who calls, "Bob-white, Bob-white!" Bird calls, however, are repetitious. Moreover, the more closely the human phrase is imitated—by, say, a parrot—the less the result sounds like whistling.

We had no trouble in locating the office of the Cabildo Insular, and no sooner had its President, Sr. don Manuel Galván Gutiérrez, extended a gracious welcome, than we were interrupted by distant whistling. "That's some of it," he said proudly, "that's what you've come to hear." Don Manuel, like many of the educated Gomerans, could understand whistling without being able to whistle; in other words, he could receive, but not transmit. "It's a Chipuden goatherd, Avelino, and another Chipuden, asking me not to leave the office until they get here," he told us, "and possibly you can have your test very soon."

This was a thrilling prospect. We had already conducted a preliminary test in Tenerife between two Gomerans visiting there, the performance being attended by the American Consul, Mr. David J. D. Myers, and by the President of the Cabildo Insular, Sr. don Maximino Acea Perdomo. Unfortunately it was far from successful, for although the Gomeran Victor could and did whistle as joyously as all the birds in a forest, still his friend could not understand a word of it. "This," explained the brazen Victor, "is because he has just had an operation on his ears!" In spite of the fiasco, we presented Victor with a coveted reward, a bottle of Canary wine, the wine once renowned as Canary sack.

As the Chipudens approached the town, their whistling grew louder. "They've something important to discuss with me," don Manuel continued. "I suppose it's a stolen goat, or a funeral to be arranged. And most likely they need money. You'll find these Chipudens interesting when they get here. They're illiterate and shy, but smart as any of us. They're good whistlers up there in the mountains; they've got to be, it's their telephone, and a lot quicker than ours!" With a smile, he went on. "Whenever we've a court trial down here, we have to keep the windows closed. Otherwise a whistler crouching under the window would whistle the proceedings to his friends, and there'd be so much noise we couldn't hear what was going on in court. And as for the tax collector," he laughed heartily, "his inspection trips are a joke. These fellows whistle that he's on his way, and when he gets there, nobody's home! . . . If you like, I'll go out and get some witnesses for your test," and don Manuel departed after giving us the three ceremonious bows demanded by Canary courtesy. In a few minutes he returned with two of the leading citizens of San Sebastián. One of these was the Secretary of the Cabildo Insular, Sr. don Carmelo Luis Ros Alférez; the other, a lawyer, Sr. don Sebastián Ascanio García. With them came also a few others who wished to be present as mere spectators.

◄Typical village street, el Monte, Gran Canaria

When the Chipudens finally strode into the office, we noticed they carried long poles with iron tips. These, don Manuel told us, were for vaulting over the rocks and leaping their way down to the valley. We made the gross mistake of asking them then and there to whistle something for us. The effect was a blast so loud that it was as if a giant locomotive had invaded the room to try out its whistle. The windows rattled, and I thought we should be permanently deaf.

When we had recovered, we invited them to take part in our test, and in due time we all climbed into the *guagua* and drove to a spot a few miles beyond the edge of the town where the road came to an abrupt end. There we filed out, passing a group of peons with picks and shovels who were extending the road. Two of them, who claimed to be expert whistlers, joined us. When once these peons have pushed the lethal needle into the heart of the island, we thought, when once the road has pumped modernity into the mountain regions, then a new island will arise and the Guanche whistling will be cast aside like a worn-out coat, to fall back into the dusty legends that shroud its origin.

As the location here provided a suitable *barranco,* we split into two groups, the one crossing, the other remaining. I chose don Carmelo as my witness, and the peon, José, as my whistler. My husband took don Sebastián as witness, and the Chipuden goatherd, Avelino, as whistler. The remaining persons, equally divided, completed the groups, and when we faced each other across the *barranco,* we tried to shout across, but the sounds did not carry.

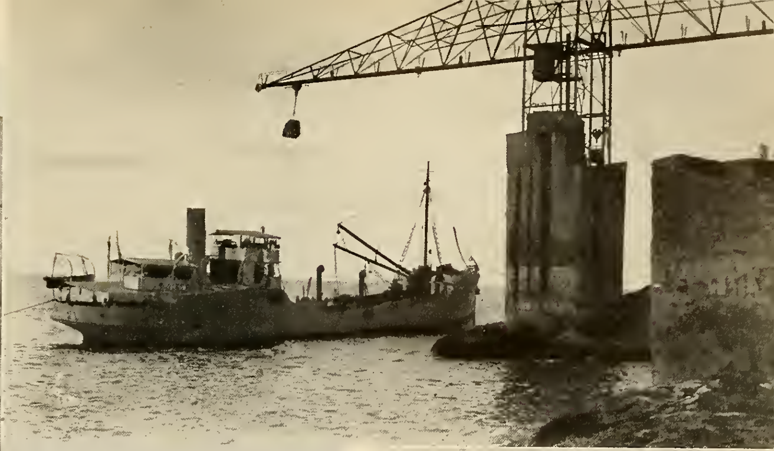
In tense expectation, I sent the first message. It was, "Avelino, pick up two stones," and while don Carmelo repeated it slowly to José, I wrote down the exact wording for future reference. That was the procedure followed each time by both the sending and receiving sides. José, putting two fingers into his mouth, sent forth some piercing flutelike tones that slid up and down the scale and ended with a downward glissando, and my heart danced when I saw the silhouette of Avelino bending down to pick up something. Comparing my notes with my husband's later on, we found that my message had been received as, "Avelino, pick up a stone." This slight inaccuracy we attributed to the extreme diffidence of the whistlers. To them, talking by whistling was almost as natural as talking the usual way, but to do so in an official test, that was indeed a strain.

The next message came over to my side. Avelino commanded José to take off his hat. Instantly the hat came off with a flourish. We asked each other what day of the week it was, and got the right answer, and likewise the date of the month. Altogether nine other messages were transmitted with manifest clarity. All the commands were properly executed and the questions correctly answered except in one instance, where a bit of confusion proved irrefutably the genuineness of the test. Knowing that the opposite side had a newspaper with them, I told José to whistle to Avelino to "read the newspaper." Nothing happened because, of course, Avelino could not read. I changed the message and had José whistle it as, "Tell them to hand you a newspaper." Again nothing happened; Avelino had not understood.

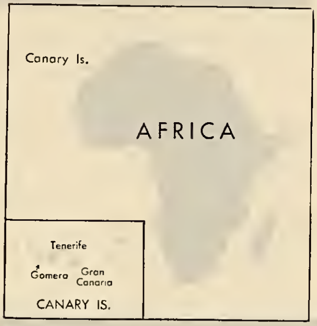
"You see, Mrs. Very," interposed don Carmelo, "there's no paper published on Gomera, and I doubt if these whistlers know the word *periódico,* newspaper. Let's substitute the word *papel,* piece of paper, and see if Avelino gets it."

When the message was sent with the more common word, Avelino

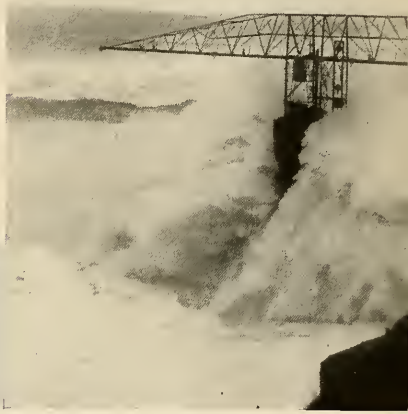
▼ POTTERY "FACTORY," Gran Canaria



▲ AT HERMIGUA, a huge crane hoists passengers from the boat



➤ IN ROUGH WEATHER like this, visitors cannot be lifted in the basket, because the waves dash a full 60 feet into the air



Sebastian Olives photographs

instantly and triumphantly asked them for "a paper." From this we concluded that only everyday words occur in the language, and the experience of Dr. René Verneau, the eminent French scientist and physician, may be looked upon as an exception. Some years ago he came to the island for anthropological research. He asked his guide not to let it be known that he was a physician, but the guide whistled without restraint, and when they reached the first pueblo in the interior, all the sick from miles around were waiting to consult "the doctor from Paris." Presumably Paris was not a word in their daily talk.

One of the questions in our test brought an unexpected reply. I had inquired, "Who are those persons with you over there?" supposing the reply would certainly include the lawyer and the American *"yanqui."* Quick as a flash came the answer, "Some peons working on the road." What should the goatherd care about his foreign audience? He was conscious of the near-by peons and the road inching its way beyond San Sebastián.

The test over, we rose to join forces. Some insistent whistling, coming from farther away, seemed to puzzle and embarrass don Carmelo. Reluctantly he said, "I can't make head or tail out of it, but somebody is saying, 'Bring me some of the wine when you get it.'"

Victor, who had performed for us in Tenerife, had come back to Gomera! Little did he know that he was contributing the crowning factor of success to the performance by referring to the reward. It was a wholly unprompted expression of thought and the final proof that spontaneous conversations could take place. This was truly talking by whistling.

Back at the Cabildo office, our *barranco* notes were typed, with a few words explaining the circumstances and purpose of the test. The principal participants signed it, the names of the whistlers were recorded and seals of the Island, the Archipelago, and the Republic of Spain were affixed. The document was then deposited in the archives of Gomera and was, we were told, the only official test of whistling ever recorded there. Facsimile originals, bearing the same seals and signatures, have since been presented to the Library of the University of Arizona and to the Free Library of Philadelphia.

As President of his Cabildo, don Manuel was eager to have us explore the regions of Chipude and

Valle Gran Rey, where the best whistling might be heard. Hermigua seemed to be the logical starting point, but to reach Hermigua we would have to follow a difficult trail over the mountains or else get there by sea. Don Manuel made the choice for us and arranged a *falua*, manned by seven sturdy Gomerans. As we shoved off, we took three punctilious bows of farewell.

For several hours we wobbled through seas so heavy that we had to hold tight to the seat. The shore was an endless line of impressive cliffs, showing folds and tilts and all the weird rock formations that Mother Earth in her prehistoric labor could have produced. There was not a stick of vegetation, not a goat path to be seen, and a more bleak and inhospitable habitat the Guanches could scarcely have chosen.

Above the engine's roar and the slapping of noisy waves, one of the crew shouted to us, "See that house up there?" He pointed to a cottage perched like an eagle's nest among the crags of the summit. "Whenever anyone gets sick up there, they whistle over to the next peak, and from there to the next, and before long the news reaches San Sebastián and the doctor starts off on his horse." Turning off the engine, he came and sat beside us, and while we rocked and bounced for all the world like drifting Guanches, he went on with his tales about whistling. "It was about 1906, if I remember rightly," he continued, "that Alfonso XIII came down from the peninsula. We got a couple of soldiers, in training for the militia, to whistle for him. The King was so pleased by what they could do that he asked what they'd like as a present from him. 'Three months' leave,' they whistled. In those days, three months was the period every conscript on the island had to serve each year. 'You can have it,' promised the King, 'and not for three months, but forever!' " This story we heard again from the Assistant Mayor of Santa Cruz in Tenerife, Sr. don Rafael Calzadilla Dugour, who had stood at the King's elbow.

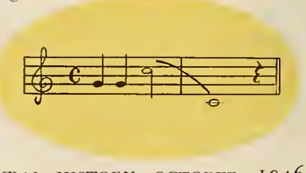
At long last we arrived, blown and weary, at the diminutive bay of Hermigua. High above us lay the giant crane, like a sleeping crocodile waiting for the steamer's unpredictable call. When we had been disgorged on terra firma, we found ourselves being greeted by the Mayor of Hermigua, Sr. don Gregorio Ascanio y Ascanio. He bowed us ceremoniously into a wonderful automobile, one of the very few cars on the island, and drove us to the end of the road and back, a distance of three or four miles. One of his stories especially bears repeating. It seems that his duties as Alcalde included riding a horse through the Chipude region to keep an eye open for illicit charcoal burning. With a kindly twinkle he confessed he rarely caught the culprits because his approach would be whistled ahead.

Our drive ended at Villa Paz, the private house of an English woman who years ago had come to the island for a fortnight and had never chosen to leave. With inimitable British hospitality, Señorita doña Florencia Stephen took us into her home as casually as if we had belonged there from the start. She had organized a private school in her house and was devoting her years to teaching the children of Hermigua to read and write. Her elation in this good work was tempered, as was our own, by the knowledge that when illiteracy had been stamped out and the new road connected the villages, there would be no further need for the whistled language, and one of mankind's most ingenious achievements would be lost.

During our stay with doña Florencia, we met a young Herminguan engineer, Sr. don Vicente Leon Bencomo, a highly cultured man of acumen and integrity. We discussed with him the possibility of a musical basis for the whistled language. He thought it possible that certain phrases could be written down by some system of musical notation. It was the opinion of another Gomeran, Colonel José Rodrigo Vallabriga, with whom we had spoken in Tenerife, that whole sentences could be played on the piano! Don Vicente was more conservative, but he was convinced that the vowels at least had their fixed positions on the scale. When he attempted to illustrate, he whistled the first three vowels in ascending progression, followed by *o* and *u* which dropped lower than the *a*. He did it again, and again the *a*, *e*, and *i* went up, and the last two dropped down, but the intervals were irregular and immeasurable. "Listen closely this time," he cautioned, "and see if it is a question of quarter tones." His successive renderings seemed capriciously different and we were more confused than ever.

"What about consonants?" we asked. These, our friend admitted, were inexplicable even to him. He said he could readily *hear* them, but he was unable to say why. We understood what he meant by *hearing* them, because we had ourselves heard the consonants when our waitress whistled *Pepe*. And on another occasion, in listening to a whistled conversation, we clearly heard the word *muchacha*, including the consonants as well as the vowels. It is my guess that words as nearly alike as, say, *cantado*, *cargado*, and *casado*, are distinguishable only by an intricacy of tone, timbre, pitch, rhythm, and intensity, much the same as by accentuation and inflection in ordinary speech. The variations in whistling admittedly defy detection by the novice; they are as subtle as the shifting of the wind or the falling of rain.

We took to the mountains one day with a guide who, in true Gomera fashion, ran along behind us. The trail was narrow and we had to ride single file much of the time. To pass the time away I began to whistle a song taught us by a caged bird at Villa Paz which wakened us every morning with the same notes. "Way-way-weeeeeewo," I whistled, as loud as I could and with approximately the following tune:

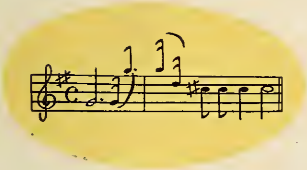


◄ Folk-dancing, Tenerife

A. Benitez photo

"What does the *señora* wish?" asked the guide, suddenly appearing beside me. I assured him I wanted nothing. "But the *señora* has been whistling my name, *Federico*!"

Amazed and amused, I whistled the second half of the bird's song, "Ho-haaaaaay-heea," with the following notes:



"This time," he told me, "the *señora* is whistling *Florencia!*" Later we learned that doña Florencia's bird had once belonged to a man named Federico, and each day at dawn it loyally greeted both its owners.

The farther inland we rode, the rougher grew the topography. In every direction mountains lay scattered about with as little symmetry as chess men on an upset board. To dizzy heights we climbed, following razor back ridges and then down again into the deep *barrancos,* passing here and there through a forest hugging the less steep slopes. Often the trail was terraced, to keep hoofs from sliding down a thousand feet at one swoop, and long stretches were cobbled for the same purpose. Federico had a habit of stealing up from behind and slapping our beasts, making them jump without warning, so that the only safe position was at the head of the line.

We stopped to rest, and Federico abruptly turned to my husband. "*Señor,* I can make a whistler of you in six lessons," and he thrust two large fingers into my husband's unsuspecting mouth. Without such intervention, however, we learned to whistle one single sentence, and a useful one it proved to be. "*No entiendo,* . . . I don't understand."

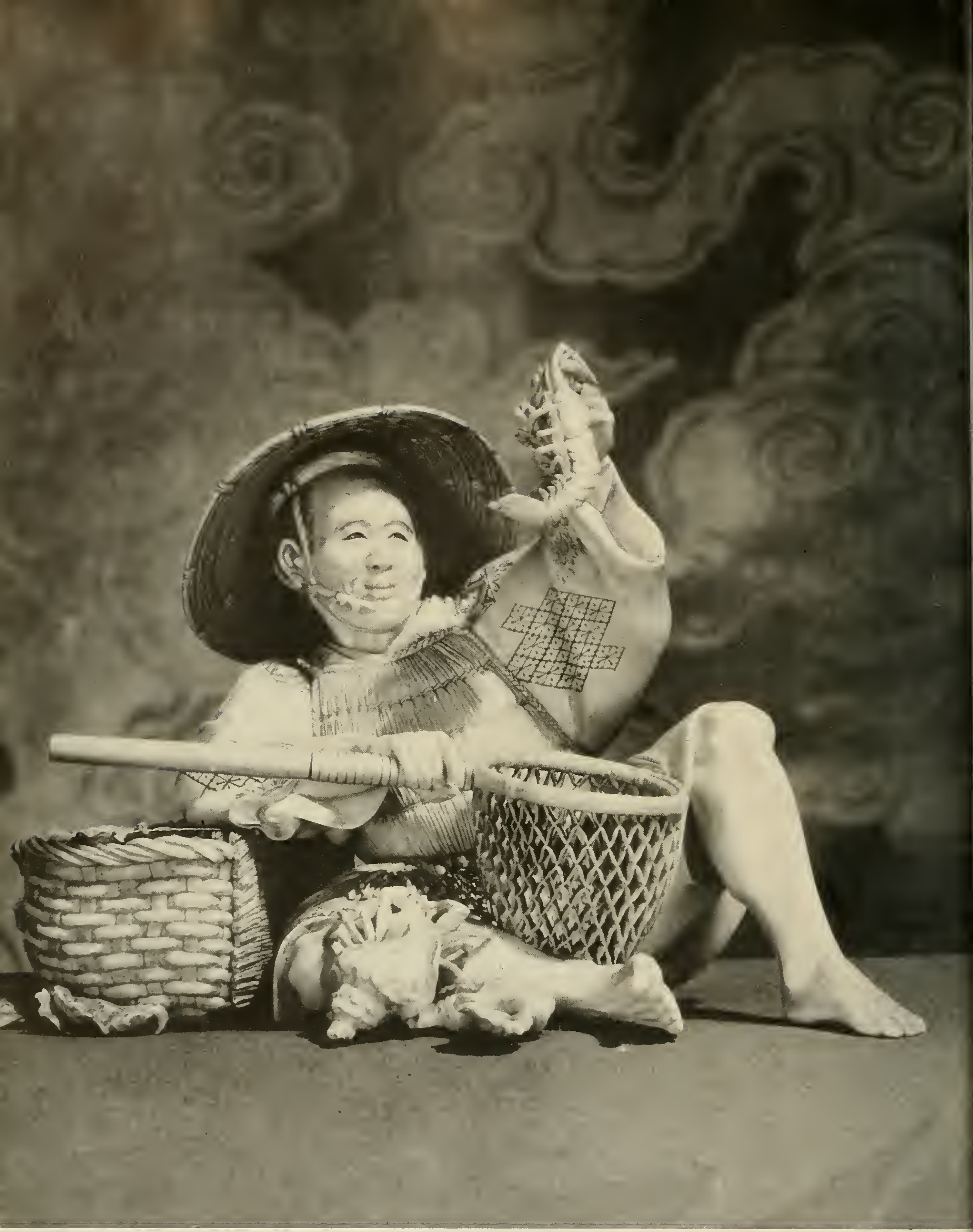
We caught frequent glimpses of Tenerife and its snow-capped peak of Teide rising over 12,000 feet from the sea and looking so close through the clear atmosphere that it seemed as if a whistler could be heard there. As a matter of fact, the distance a conversation can be whistled has never been established. On a still night the natives claim it will carry five miles and more, but of this we ourselves have no proof.

Our time in Gomera was too short to do more than to satisfy ourselves that the language exists and that it is in everyday use as a means of exchanging spontaneous thought. It is limited to common words, and although most educated Gomerans can understand it, only the isolated goatherds in the mountains become expert in using it. It is greatly to be hoped that further investigations will be conducted and that phonographic recordings will be made, so that at least a fragment of this strange idiom may be preserved among the wonders of the world.

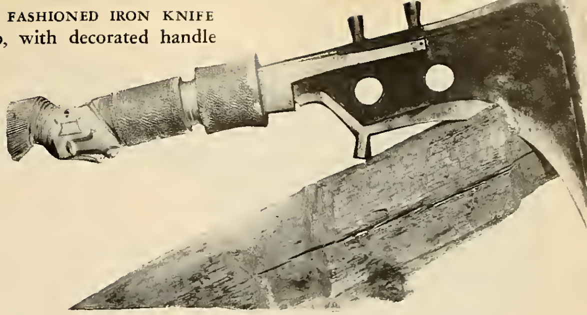
As to *why* the Gomerans talk by whistling, we need not accept the myth of the missing tongues. We have only to glance at the topography of their island, with its high peaks and deep *barrancos.* But if you ask them *how* they do it, they will tell you as they told us, "All you have to do is, *get ready to speak the words and then whistle them.*"

As easy as that!

➤ Cave house, Gran Canaria



▲ Realistic ivory carving of a Japanese fisherman



A STRANGELY FASHIONED IRON KNIFE from the Congo, with decorated handle

Carvings

A new temporary exhibit at the American Museum of Natural History will present a selection of the most interesting carvings culled from one of the world's largest collections of native handiwork. The exhibit will open on October thirty-first and continue until February second

All photos by A. M. N. H.

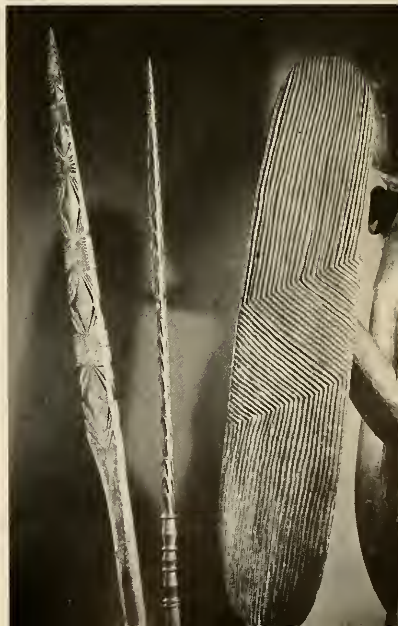
SINCE the days when Cro-Magnon Man decorated the walls of his caves in southwestern Europe with highly artistic drawings of animals now extinct, people throughout the world have given expression to the basic impulse to create something beautiful.

Neither the hardships of a hazardous life nor the lack of metal implements has prevented man from exercising his artistic talent as a carver of wood, ivory, bone, or stone. The so-called "savage" brilliantly exemplifies the doctrine that "a good workman never blames his tools." He often shows a freedom of spirit that puts to shame the modes and fads of our gadget civilization. His spirit is not enslaved by economic objectives or the technical demands of mass production. Rather, his aim is to create, against the background of his native traditions, something that transcends the commonplace.

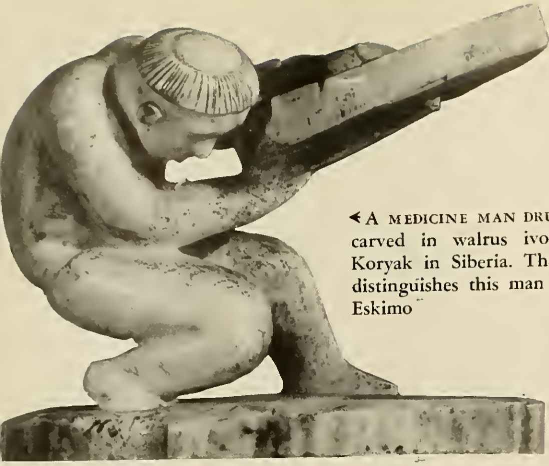
Sometimes he carves simply as a pastime; sometimes he works under the stimulus of a religious emotion. Fear of the unseen world may, at one time, cause him to inspire horror through his artistry, at another, to prove that a gift to the gods should be beautiful as well as useful.

Native carvings are not all good carvings any more than an old piece of furniture is necessarily a beautiful piece. But against the mental, spiritual, and physical background of their origin they are almost invariably interesting. Native carvings from a given region are usually so distinctive in style that if one examines the exhibits in any large museum, he may soon begin to guess from what part of the world a certain piece has come.

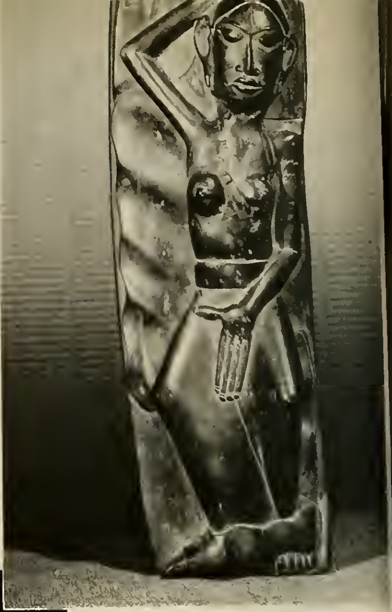
As increased leisure gives us more time for the development of artistic hobbies, we can learn much from the ways in which native peoples have applied their talents. Manufacturers are beginning to draw upon the inexhaustible sources of native art, and this can enrich our daily lives in many ways. But we should remember that there is a difference between the unique hand-carved object and copies that borrow from it and are produced one-a-second by injection molding.



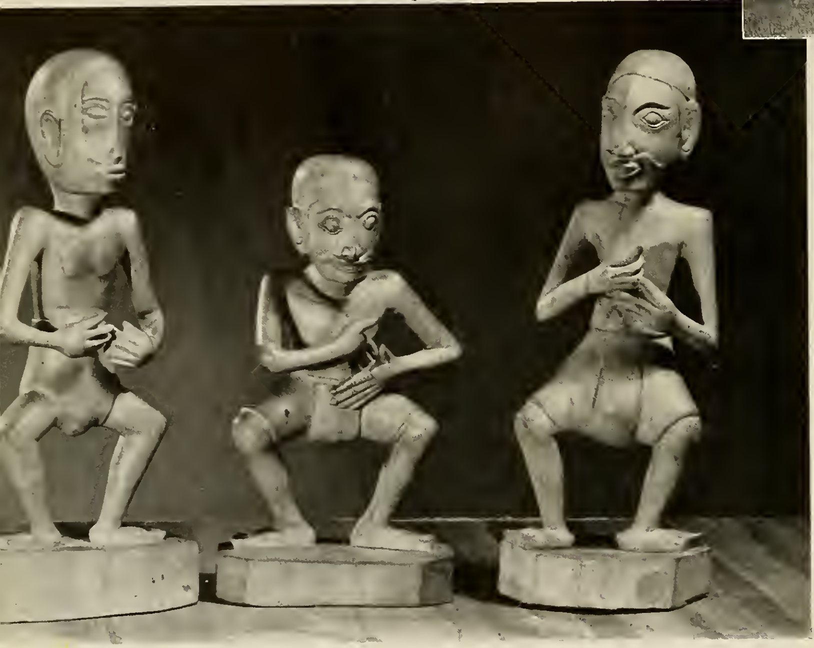
➤THE CARVER'S ART expressed in tools of war and the chase: Samoan spears and an Australian shield. The zigzag design makes Australian shields easy to recognize



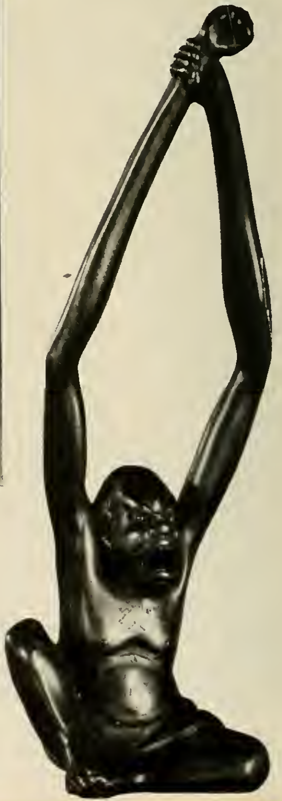
◀ A MEDICINE MAN DRUMMING, carved in walrus ivory by a Koryak in Siberia. The haircut distinguishes this man from an Eskimo



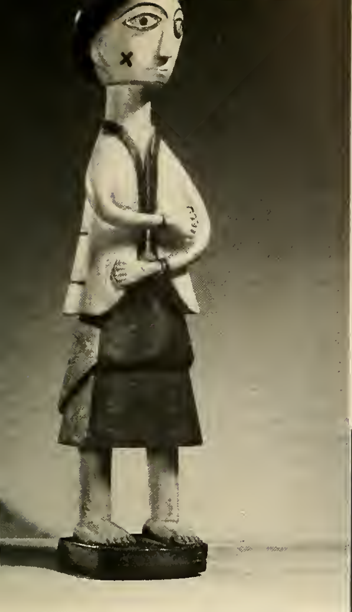
▲ BALINESE carving that reflects the influence of local terpsichorean art



▲ LEGENDARY FIGURE OF BALI, as carved by a layman, a craftsman, and an artist. The Balinese have distinguished themselves in woodcarving as a pastime. The American Museum collections contain no fewer than 1000 examples of their work



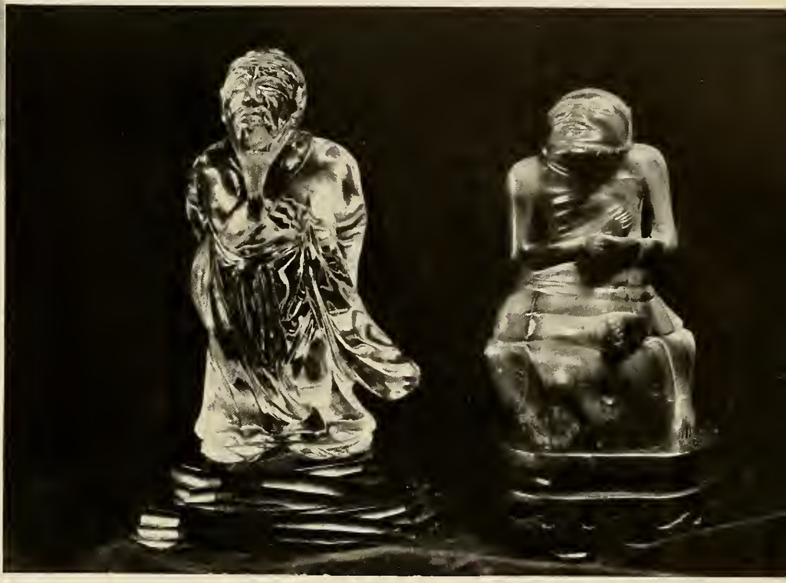
➤ AN UNUSUAL wood carving from Japan



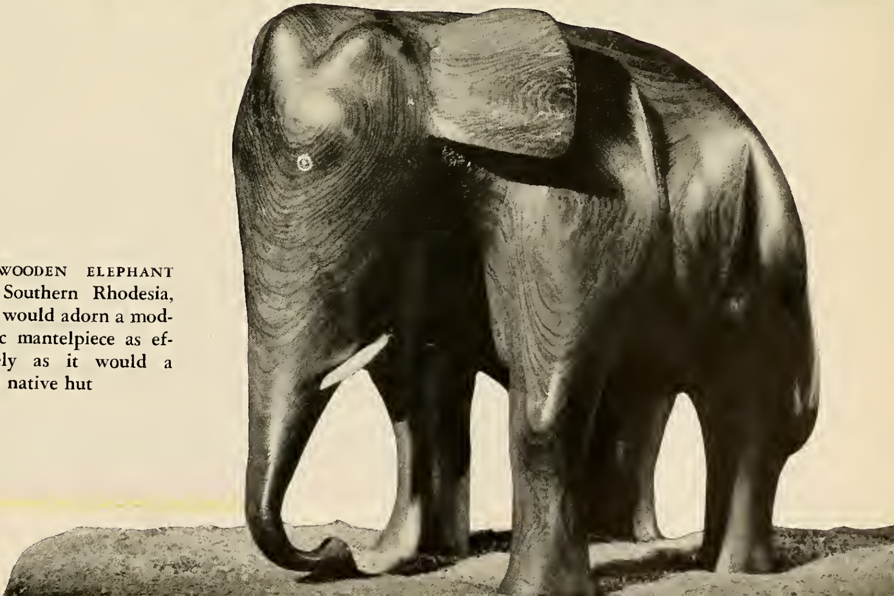
▲ A **wood carving** displaying a West African's conception of a European woman

Figures CULTIC OR ORNAMENTAL

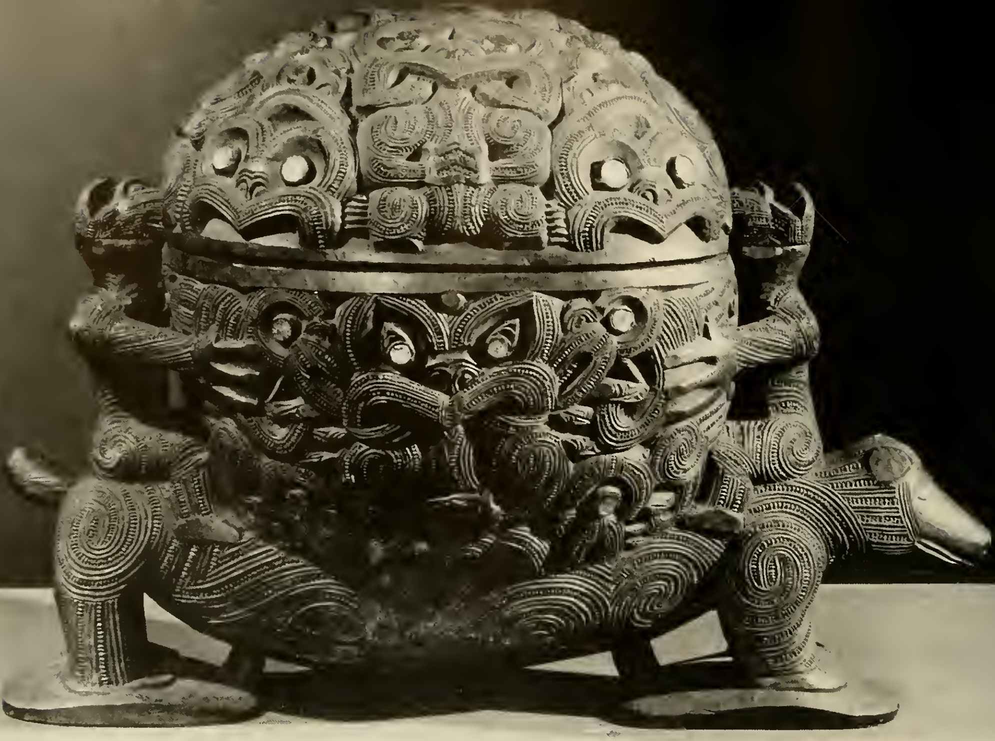
HUMAN figures and animal carvings are among the most plentiful objects of art both in primitive and civilized society. Note how grotesque posture and the texture or grain of the material impart a "flavor" to these figures not attained by photographic or other realistic likenesses of things. The primitive artist, like his more sophisticated cousin, makes free use of caricature. By exaggerating certain features he makes the personality of his subject more apparent and in one figure sometimes gives delineation to a whole class of objects in a way that would be impossible through slavish portrayal of a single subject. Imagination joins with a fine use of the carver's tools to produce these figures.



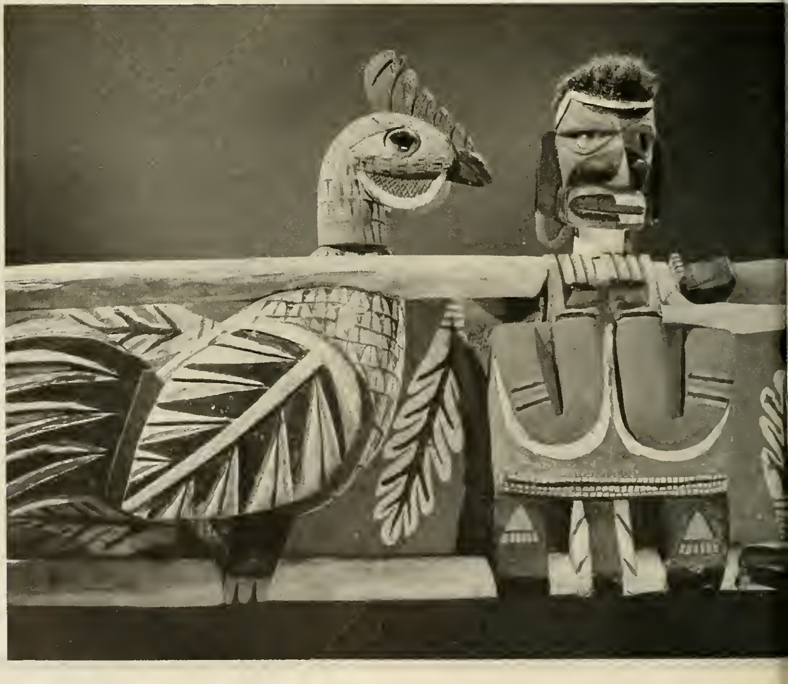
➤ **China and Japan.** (*Left*) Japanese figure of Sastzu carved in rock crystal, showing the characteristic realistic treatment. (*Right*) Chinese carved figure of the Taoist hermit Takkai, showing typical Chinese conventionalization



➤ A **wooden elephant** from Southern Rhodesia, which would adorn a modernistic mantelpiece as effectively as it would a simple native hut



▲An intricately carved feast dish of the Maoris of New Zealand, a people who, like the Indians of our Northwest Coast, have distinguished themselves as carvers of wood

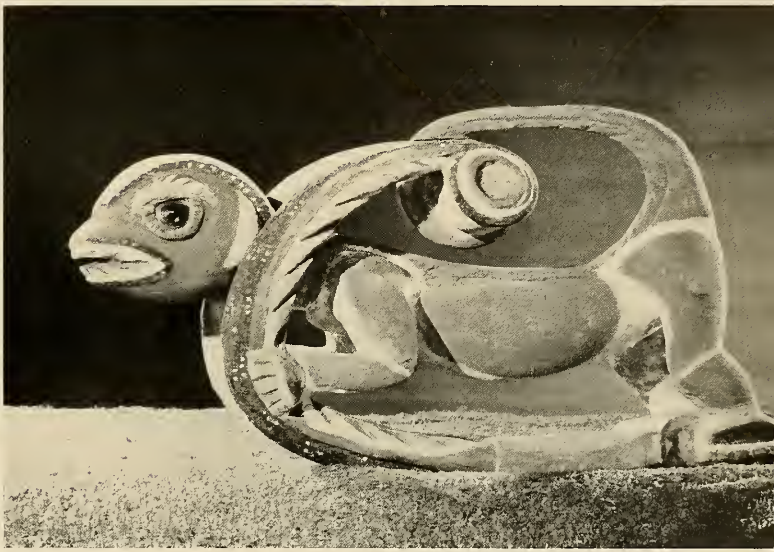


➤Part of the sacred carving at the entrance to a ghost house in New Ireland, in the Bismarck Archipelago

▲ A **WOODEN BELL** from the Congo

Sacred Objects

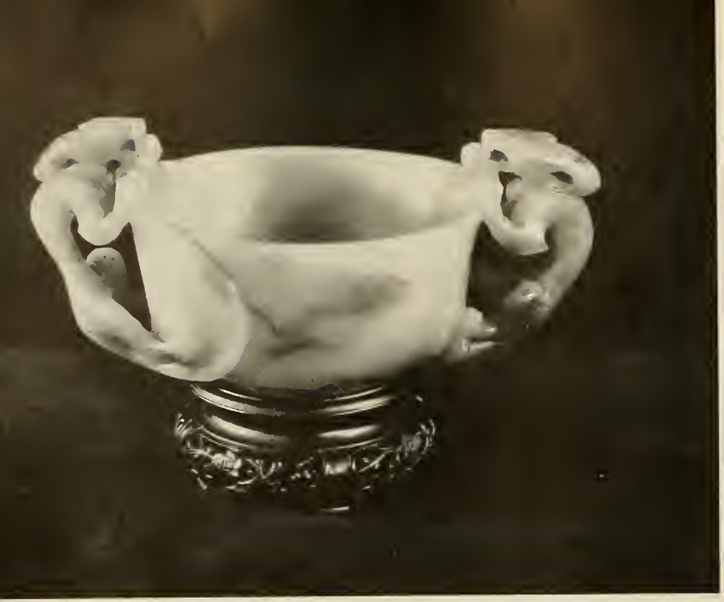
CARVINGS with religious import command the native's utmost artistry and offer a rich avenue for insight into his psychology. For the native will often lavish more care on a carving that is to win the favor of the spirits than he will on a spear that is to get him his next meal. And embellishments on the latter, indeed, are often of a religious sort. Sacred carvings reveal the artist's conception of the spirit world, a world scarcely less real to him than the actual world but distorted in ways characteristic of the religious thought of his tribe. Frequently the object is not merely a representation of the spirit; it is believed to *contain* the spirit. The patience and skill with which the carver fashions these objects is the more remarkable when we realize that many of them are only brought out for use once a year. Many that are well preserved may be very old.



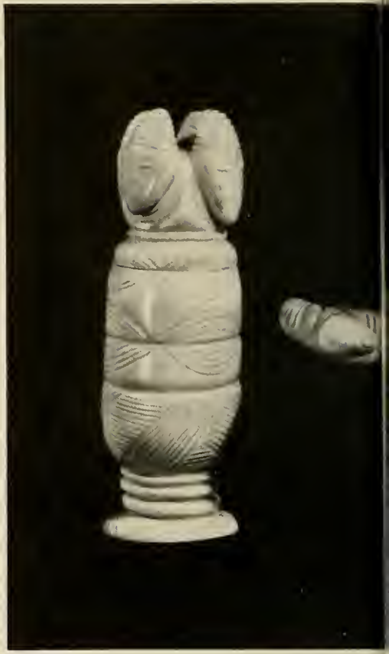
▲ A **CEREMONIAL CARVING** from New Ireland

▲ **CARVED WOODEN DANCE WAND** from the Trobriand Islands, a low coral group southeast of New Guinea

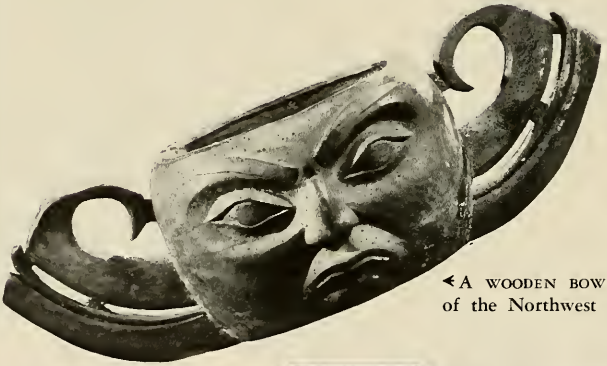
➤ A **KACHINA DOLL**, Southwest Indians. Dolls of this sort are fashioned in a multitude of forms by the Zuñis and Hopis to represent the gods in their dances, but always in a style that distinguishes them from fetish art elsewhere



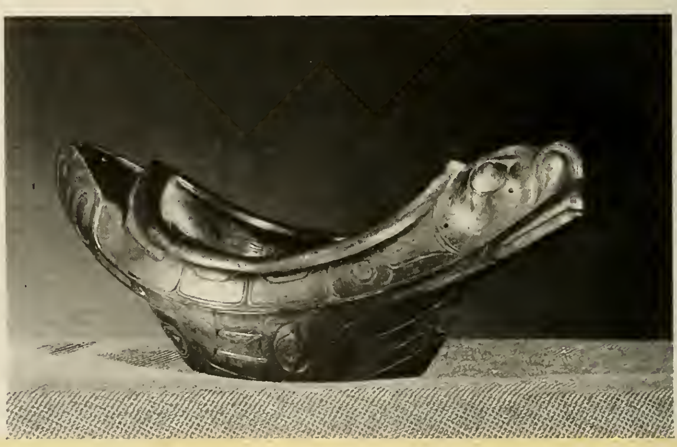
▲ WHITE JADE CUP carved with dragon handles in Ming style. K'ien Lung period (A.D. 1736-1796)



▲ IVORY CARVINGS: a decorated box and oil dish from the Congo



◄ A WOODEN BOWL carved by the Indians of the Northwest Coast of North America

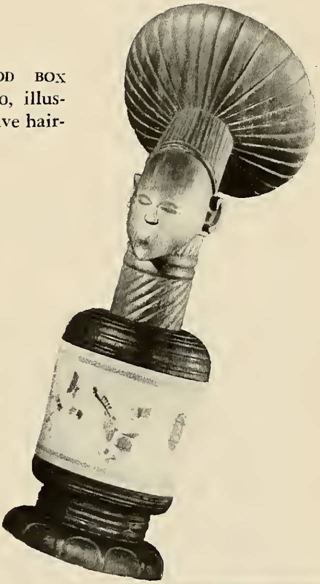


► A GREASE DISH of wood, likewise from the Northwest Coast Indians

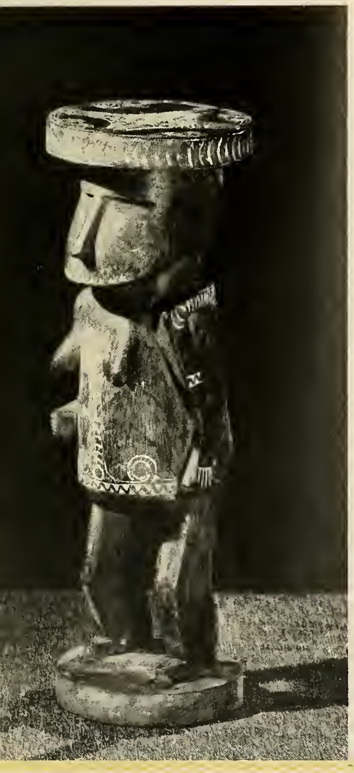
Household Pieces

OBJECTS of daily use in the home frequently embody decorative designs that are semi-religious or mythological in character, and it is sometimes difficult to draw the line between good luck symbols and pure ornamentation.

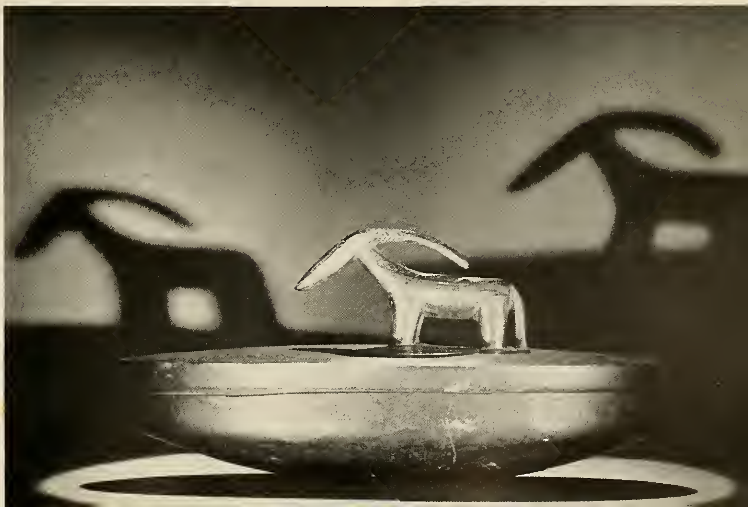
People who live by hunting, fishing, or simple agriculture rarely have articles in the home that do not serve some useful purpose. But it is also rare for them to make an implement without any attempt at ornamentation, and sometimes it seems as though the hours spent in decorating an object must exceed the hours spent in using it. But the time is not lost, for there is pleasure in the skillful use of carving tools as well as in the beauty of the finished object. The native has, in a sense, discovered for himself the value of occupational therapy to counterbalance the rigors of life close to nature. And then there is always the hope that he may distinguish himself among his fellows as a skillful carver.



➤ Ivory and wood box from African Congo, illustrating a type of native hairdress



◄ A stool in the form of a man, illustrating the carving art of the D'Entrecasteaux Islands, New Guinea

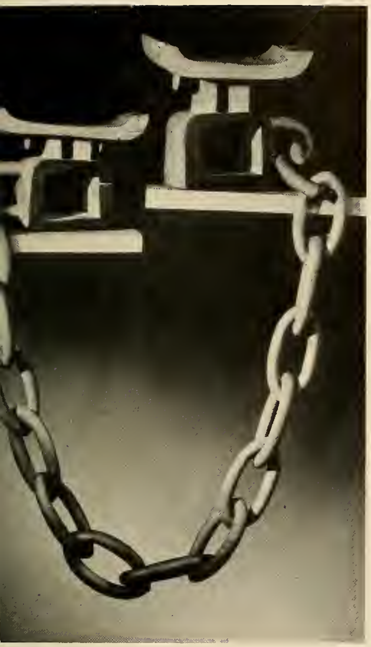


▼ Covered wooden antelope bowl of the Barotse tribe in Northern Rhodesia: beauty achieved through utmost simplicity of line

◂ Spoons: (*top*) an example carved in wood, Philippine Islands; (*middle*) a carving by the Eastern Woodlands Indians; (*bottom*) a horn spoon from Siberia

➤ Ivory pipe stem decorated with carved whales, Alaskan Eskimo

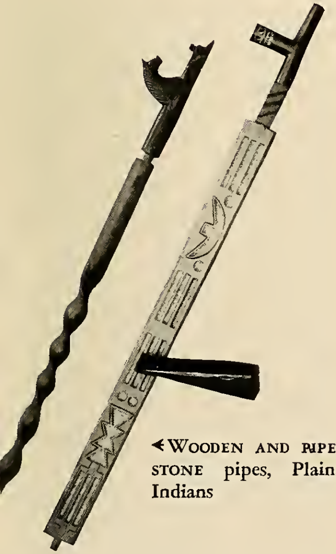
▾ Ivory and horn spoon from the Northwest Coast Indians



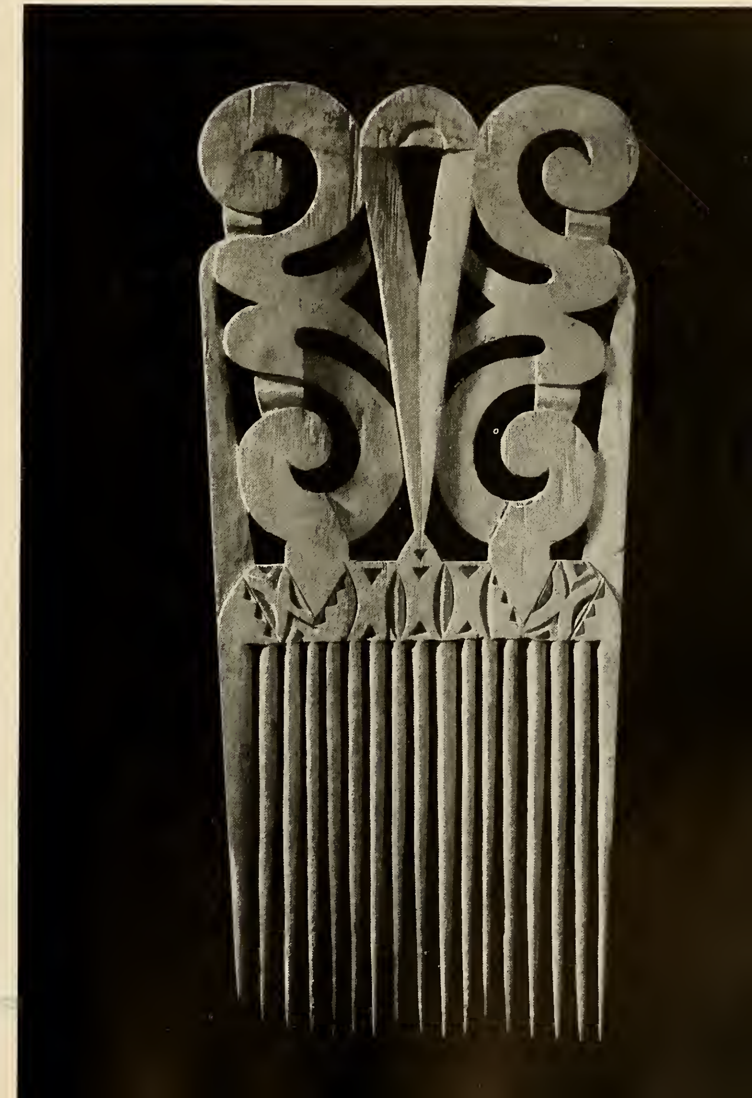
▲ A PAIR of head rests, Southern Rhodesia

Close to One's Person

IF all of us had to carve our own spoons, combs, and pipes, we would have more difficulty concealing undeveloped artistic talents. In the native village, finely carved objects are passed down from generation to generation, carrying with them in family memory some of the personality of the person who fashioned them. Thus the use of tools, whereby man raises himself above other creatures, remains an expression of the individual. Unlike the workman on a long production line, whose tool performs only one operation, the native craftsman has the satisfaction of completing an article entirely himself. He usually works in his family group, and he can vary the design at will. But artistic tradition usually holds him to the basic symbolism of his tribe. The examples shown here give some impression of the distinctive modes in primitive art, but they are only a few of the many carvings that will be in the special exhibit at the American Museum.



◄WOODEN AND PIPESTONE pipes, Plains Indians



➤A WOMAN'S COMB carved by the Bush Negroes in Dutch Guiana

▲ "... FOR ALL THE WORLD as if he could get a better shot than I could"

BEARS

By LYNWOOD CHACE

All photos by the author

THE most amusing and interesting experience I ever had was in producing a movie of the activities of two black bear cubs. The required scenes presented some difficult problems, such as the cubs breaking into a wild beehive in a hollow tree.

Now, to pack your movie camera equipment on your back and start hunting in bear country with the expectation of coming upon just such a happening would be almost as hopeless as trying to reach up at night and touch the moon. There were other shots almost as difficult. I finally came to the conclusion there was only one way to get around all these obstacles. I would have to procure some cub bears somehow, then find a piece of woodland where I could keep them from escaping and yet have them in natural surroundings. This was not an easy matter. The various scenes called for certain special settings in this wooded plot, such as a large tree that had a decayed hole in it. This was to be the honeybee tree. There were no honeybees there, but I will explain that problem later.

Finally, after much traveling about the surrounding country, I found the ideal plot of woodland, including the large tree with just the right cavity in it. I obtained a helper and fenced in a section 100 feet long by 50 feet wide. I was now ready for the cubs.

I sent a telegram to Benson's animal farm, located in New Hampshire, requesting two black bear cubs. Fortunately they happened to have the cubs. The cubs (my two actors) were transported by truck to the wooded enclosure I had prepared for them.

Everything was ready to go, provided I could solve some problems that seemed to be almost impossible at the beginning. My foremost difficulty was with the wild honeybees. I had the right setting—just the type of tree bees would select for their new home—but there were no bees in the hole—and this was one of the most important scenes in the script. Well, they just had to be obtained, so I started concentrating.

Suddenly an idea came to me! I had read a book about the life of the honeybee, and remembered reading how they would rob another hive that was in a weakened condition. "That's the answer to my problem," thought I; so I went to work on the idea.

First I secured a ladder to reach the decayed spot on the tree, which was about fifteen feet from the ground. I cut out the decayed wood until I had a sizable hollow in the tree. My next task was to construct a beehive in this cavity with comb honey. I purchased four frames of comb filled with honey from a beekeeper. Next I cut the comb from the frames and began placing it carefully in the hole in the tree. While all this was going on, the cubs began to get more friendly with me—in fact, one of them got a little too much so. They seemed to have a most inquisitive nature, always wanting to find out what was going on; and each time I

IKE HONEY -*but*

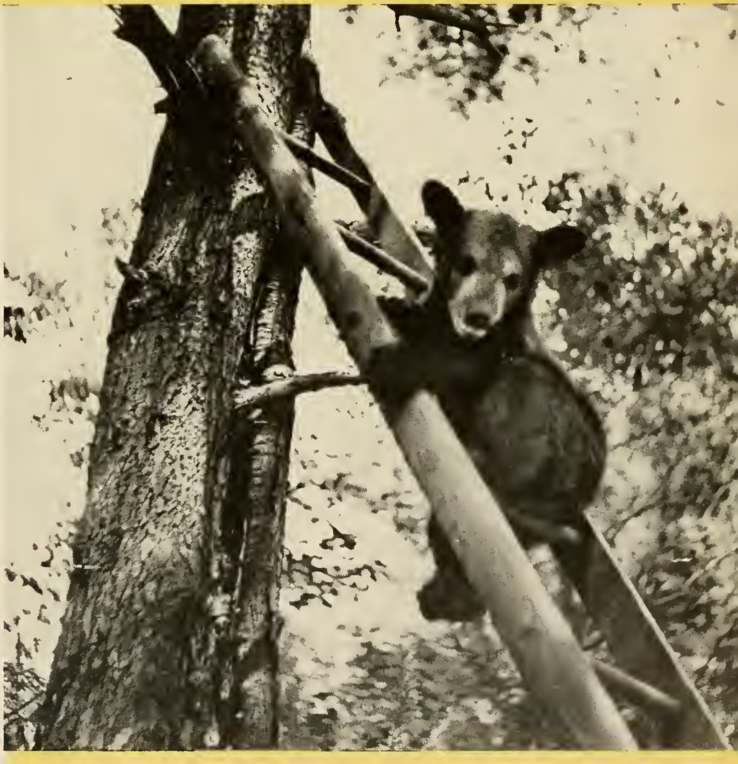
THINK TWICE BEFORE YOU TRY TO FILM THEM EATING IT

▲ "WELL, after awakening from a nap, a fellow don't always look so good"

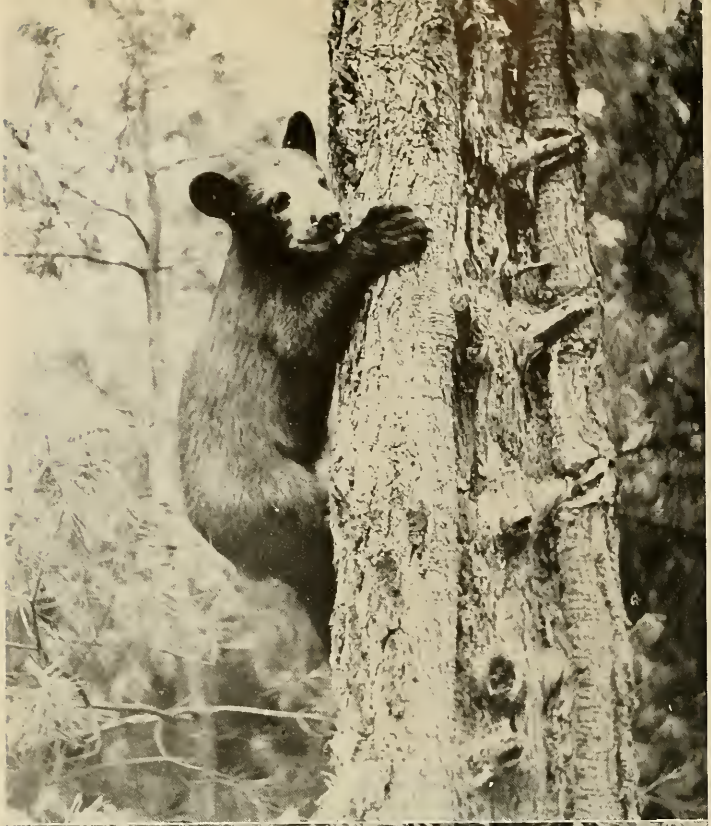
climbed the ladder to put a strip of honeycomb in the hole this one cub would climb the ladder after me, close at my heels. Just when I would get into an unstable position in constructing the beehive, the cub would try to climb up past me on the ladder. But, despite all obstacles, I finally completed my job.

Now the next procedure was to get a shot of one of the cubs taking honey from the hive. This meant a lot of preparation and patience. The first thing was to get the cub to climb the tree to the place where the honey was located. I accomplished this, after a fashion, by putting bits of honey at different heights up the tree. I placed a piece of comb five feet up the tree and coaxed the cub to climb up and get it. I repeated this until the cub reached the beehive.

All I needed now was bees—and this is where the big idea came in. I listened to all the weather reports I could, and was assured of clear weather the following day.



▲ "WHEN CLIMBING the tree to construct the beehive for the cubs, one of them followed me up the ladder. I climbed down the tree trunk and took a shot of him stranded on the ladder"



◄"I GOT THE HONEY and the bees into the hollow tree and then finally coaxed one of the cubs up to the hive by putting bits of honey at different levels"

◄"CHEWING on a decayed stump gave this cub a lot of pleasure"

So I started for the woods early the next morning, carrying with me a small box. On the way I had to pass through a field, and when I reached it I hunted about until I found a honeybee and captured it in the box. I headed for the bee tree. Climbing the ladder I carefully let the bee out of the box onto the honeycomb. The bee began to consume the honey and when filled flew off. Believe it or not, it worked! Shortly it returned, bringing back more bees. This continued until a large number of bees were coming and going and flying about the cavity. This was it!

I put my camera in readiness, then loosed the two cubs, and coaxed them to the base of the tree. One of them immediately

◄"BLACK BEAR CUBS are like any youngsters. To get rid of some of their energy, they just have to have a good scrap occasionally"

▼ "ON A HOT DAY this one liked to cool off by stretching his tummy out on the damp earth. He looked very peaceful . . ."

tarted up the tree. I rushed to the amera so as to get a shot of him limbing. However, the second cub ollowed me, evidently thinking hat in all my hurry I wanted to lay with him. When I had almost eached the camera, the cub rabbed my leg and stopped me hort—in other words, he had a ear-hug on my leg. I reached down nd finally managed to free him rom my leg, after which I rushed o the camera and started the motor.

I was so intent on getting the shot of the first cub climbing the tree that I forgot about the playful cub until very suddenly my camera stopped. I rushed over to the battery box, and sure enough, there he was, sitting on his haunches beside the box with the plug in his mouth chewing it. He evidently liked the chewy feeling of the rubber. I grabbed the plug from the cub and inserted it in the battery box. As though he had not done enough mischief, the cub jumped to his feet, ran to the camera, and started to maneuver with the various gadgets on it. It looked for all the world as though he thought he could get a better shot than I.

After jumping to the battery box several times, and several times pulling the cub loose from the camera and my own legs, I finally obtained the entire scene of the co-operative cub getting the honey from the bee tree. But I made up my mind then and there that, in the future, I'd let only one cub loose at a time, if only one cub was to be used in the scene.

↗ Time for a good snooze: a siesta with a front paw for a pillow

➤ "Getting wild honey isn't all fun. One cub got stung on the hind foot and tried his best to do something about it"

▼ "They were docile enough until I started doing something important . . ."

↘ "Some of the honey dripped to the ground from the tree, and both cubs were determined to get the last drop"

GIANT Tree Frog

A resident of Florida which probably arrived via hurricane from the Caribbean Islands

By Edna H. Evans

THE term "giant" is a relative one but, in comparison with other members of its tribe, the giant tree frog really deserves its name. It grows to be from three to five inches long, while the maximum reached by other tree frogs rarely tops two inches. Scientists give it a sizable name, too, for they call it *Hyla septentrionalis.*

The giant is an immigrant, or possibly a refugee, in this country, for its native home is farther south in the islands of the Caribbean. However, in recent decades it has become established in the vicinity of Key West, Florida, whence its forebears probably traveled via hurricane.

How can a tree frog travel by hurricane? That is really quite simple. Suppose the palm tree in which a frog makes its home is blown down by a hurricane wind. The tree has been growing close to the shore so, when it falls, it topples into the water.

Away it floats, its long green leaves acting as sails in the wind. Its tree frog tenant travels along with it, dining on the variety of insects that formerly were fellow tenants and now are passengers on the same ship.

Needless to say, such a journey is a long, hard one. Only a few trees ever reach land again and only an occasional hardy frog can survive the trip. But some do—as their presence on the Florida keys indicates—and they must hop gratefully ashore when the voyage is finally over.

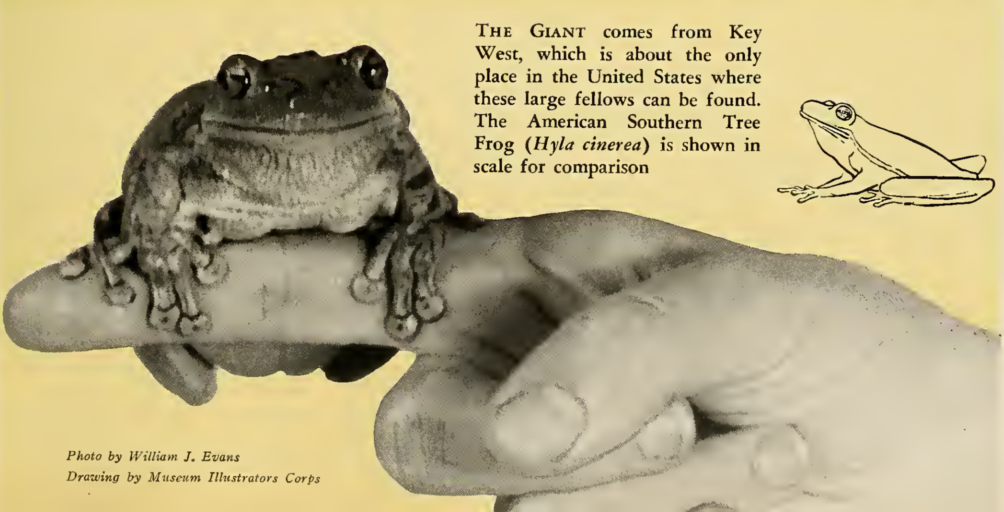
Some frogs may have traveled less romantically on shipboard, hidden away in fruit and vegetable cargoes. Even so, the trip is not an easy one and a frog's chances of survival are not great.

Once ashore in southernmost Florida the tree frogs have no trouble in making themselves at home. The climate is warm. There are plenty of insects. Tree frog boy meets tree frog girl under a Florida moon—and soon there are tadpoles swimming in some sheltered pond.

Members of the giant clan have a great liking for cisterns and rainspouts. Their chief offense, so far as their relations with human beings are concerned, comes when they accidentally clog downspouts and drains. Their voices, heard just before and after a rain, sound just about as musical as an unoiled pulley when a rope is yanked jerkily through it.

Tree frogs have bright eyes and rather cheerful expressions. Giant tree frogs are no exception. Like the rest of their clan they have disks on their toes that enable them to cling without difficulty to almost perpendicular surfaces. Special glands pour an adhesive liquid onto the surface of these disks, and tiny bristles provide friction. Since the *Hyla septentrionalis* is large, the disks on its toes are large, too, and show up more than do those on the feet of its smaller *Hyla* relatives. A tree frog can walk up a wall or across a glass window as easily as a man can walk across a room.

Giant tree frogs are mottled a mixture of gray and green and, as is customary in tree frog circles, can vary their coloration to a certain extent, depending on the weather and the general state of their dispositions. The happier they are, the brighter they are, while they save their dull brown colors to express a "morning after" mood.



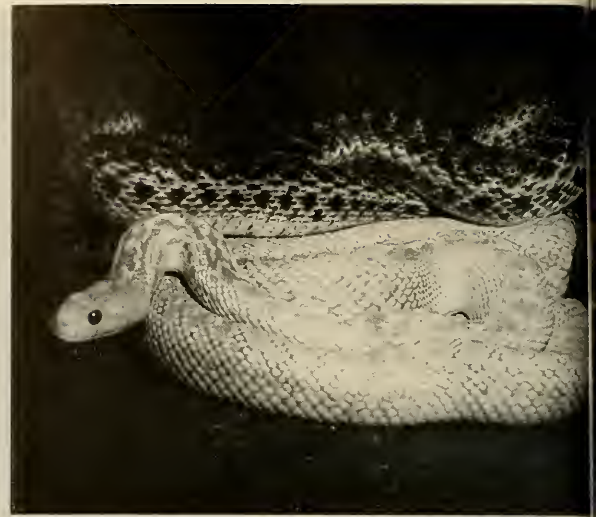
THE GIANT comes from Key West, which is about the only place in the United States where these large fellows can be found. The American Southern Tree Frog (*Hyla cinerea*) is shown in scale for comparison

Photo by William J. Evans
Drawing by Museum Illustrators Corps

Reptiles Bred TO ORDER

By Lewis Wayne Walker

Photographs by the author
Chart by Ray Schwenkmeyer



▲ Blondy the albino, and her normally colored mate

Principles of heredity illustrated by the progeny of an albino gopher snake

THAT ancient riddle,

> Brothers and sisters—have I none,
> But that man's father is my father's son,

can take a back seat when compared with a five-year experiment in the breeding of an albino gopher snake. The assumption that any snake will breed in captivity is in itself a pipe-dream, at best a vague hope with but slim chance of success. The successful hatching of snake eggs under artificial conditions has always been considered almost accidental, and the breeding of captive reptiles even more so.

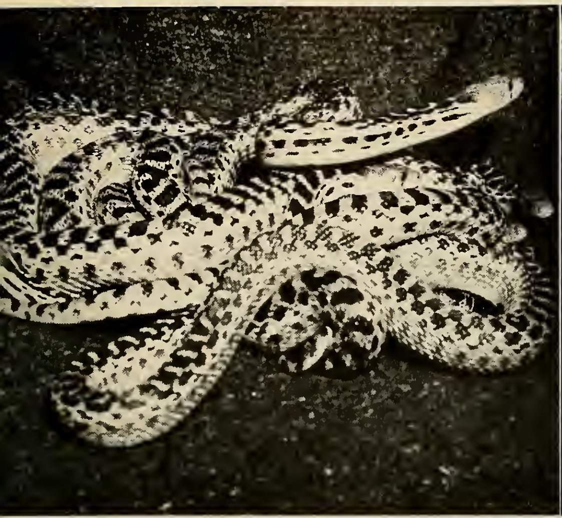
On May 24, 1940, an excited voice called the San Diego Zoo to report the capture of an albino gopher snake, *Pituophis catenifer annectens*. C. B. Perkins, Curator of Reptiles, withheld judgment until the animal could be seen. If pink-eyed, as described, it would be the second example he had ever seen of such a mutation from the normal. Years ago on the prairies of Colorado he had caught an albinistic rattler among almost 100 others procured the same day.

The gopher snake, later known as "Blondy," was a beautiful young adult female. Areas that on a normal gopher snake should have been tan were almost white on her. The blotched pattern on back and head, usually black, was in pastel colors of pinkish-yellow.

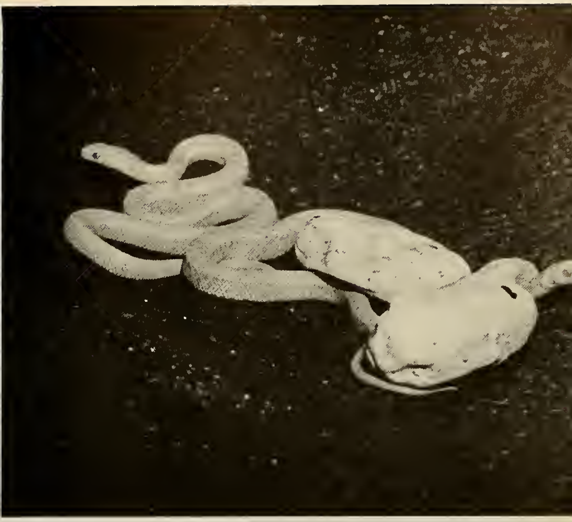
Blondy took well to captivity and became a good feeder, foregoing the weakening starvation siege so common to newly caught reptiles. On the 27th of May, just about one year after capture, a normal male gopher snake of equal size was placed in her pen and soon became known as "Blondy's Boy Friend." Although they were friendly, the association was unfruitful until July 3, 1943, when three eggs were laid. These were removed from the pen and placed in a china crock with a glass cover. Artificial humidity was maintained (in the past this had proved successful with other reptile eggs), and 67 days later two young were hatched. Although normal in color, they were, according to the Mendelian theory, color "halfbreeds" with recessive albinistic genes. While these young were growing, another mating of Blondy and Boy Friend produced five eggs on May 27, 1944, all of which hatched on August 8th. As in the first case, the dominant genes produced normal pigmentation.

Now comes the mixed-up relationship, incestuous to say the least, but nevertheless interesting. The male of the first litter from Blondy and Boy Friend had grown to a healthy adult. His dad was relegated to the pen of ordinary gopher snakes and forgotten, while the son with the unseen albinistic genes took his place with Blondy. This association produced four eggs on July 3, 1945. One was obviously infertile, but two of the remaining three hatched on September 5th. Both offspring are perfectly formed albinos. They now bear the names Pinky and Rosy. Their mother is also their grandmother, while their father is also their half-brother.

By Mendel's law some of the offspring of this last union (second generation for Blondy but first for her son) should have been of domi-



▲ **Five** of the offspring of Blondy and her normal mate. They are normal in color but have recessive albinistic genes

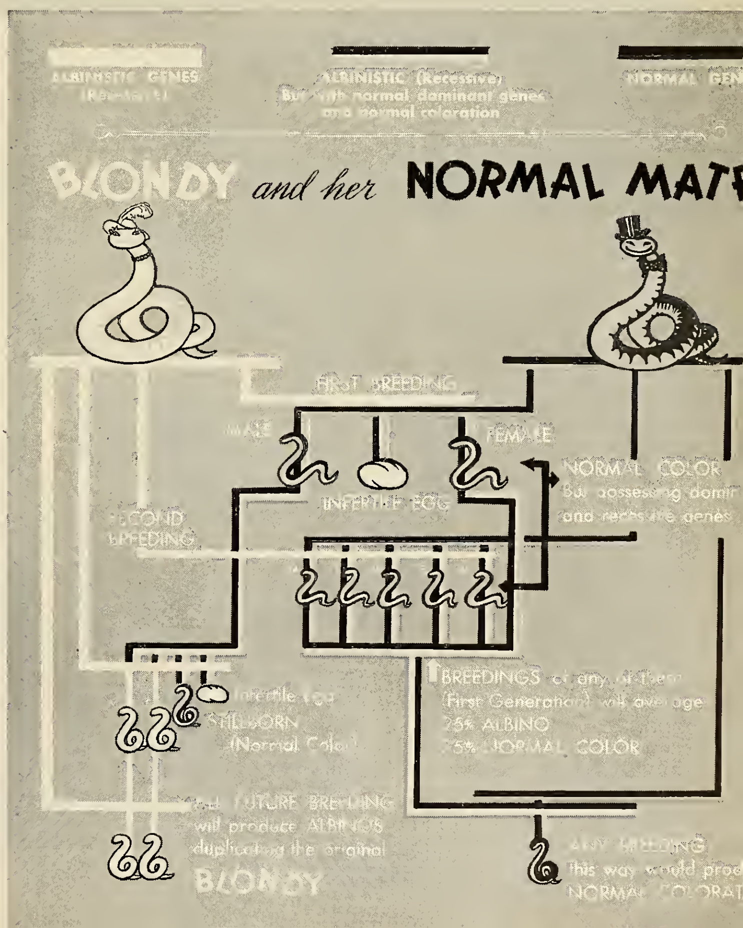


▲ **Pinky and Rosy,** shortly after emerging from their egg cases: perfectly formed albinos whose father looked normal but had recessive albinistic genes

nant normal color. However, these normals may have been the two eggs that did not hatch from the clutch of four.

The remaining six normally colored young of the first generations are being kept in a segregated cage to breed when they choose to, and chance alone will unite some of the recessive traits and produce a percentage of albinos. Blondy will be kept with her present mate until one of her albinistic "grandchildren" matures and in turn becomes her mate. Then, if all goes well, the albino strain will be set for all time, with offspring that will be both children and great-grandchildren of the original Blondy.

Shortly before the gopher snake eggs hatched to albinos a beautiful pink-eyed albinistic king snake was caught in San Diego County and given to Mr. Perkins. Its general body color is a light slate or blue-gray, while the pattern, normally yellow, remains the same. Its future will be similar to Blondy's history, if it happens to be one of those reptiles that is amenable to reason and doesn't mind family ties that are more than just binding.


ALBINISTIC GENES
(Recessive)
ALBINISTIC (Recessive)
But with normal dominant genes
and normal coloration
NORMAL GEN
BLONDY and her NORMAL MAT
FIRST BREEDING
MALE
FEMALE
INFERTILE EGG
NORMAL COLOR
but possessing domi
and recessive genes
SECOND
BREEDING
Infertile Egg
STILLBORN
(Normal Color)
BREEDINGS of any of these
(First Generation) will average
25% ALBINO
75% NORMAL COLOR
ALL FUTURE BREEDING
will produce ALBINOS
duplicating the original
BLONDY
ANY BREEDING
this way would prod
NORMAL COLORAT

THE THIRD IN A SERIES ON THE
FLOWERS OF THE FOUR SEASONS

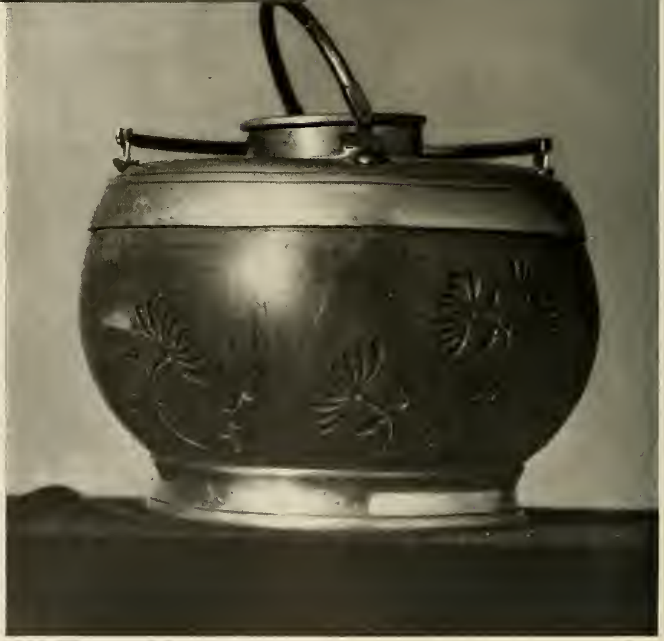
The CHRYSANTHEMUM

To many Americans the mention of a chrysanthemum immediately evokes a picture of cheering crowds at a football game. But in the mind of the Chinese this flower is associated with the peony, lotus, and *mei-hua* or "plum flower," the other three members of the quartet known as *ssu chi hua,* or "four season flowers." Aptly called "China's most glorious floral gift to the West," the chrysanthemum is emblematic of autumn. It is also the symbol of joviality.

It has been suggested that this latter meaning is due to the fact that the harvest season is naturally a time of joyousness. The period of in-gathered crops brings its feeling of abundant gladness which may be fittingly typified by the flower of the season.

". . . CHRYSANTHEMUMS
Vie with each other in yielding
their sweet fragrance.
The weather tells us that the ninth
month is approaching."

—Yen Shu (An official in A.D. 1042)
(Translated by Helen Wiley Dutton and used with her permission)



➤THIS WINEPOT of pewter and gourdshell is enhanced by simply carved chrysanthemum sprays

Author's collection

hinese Symbol of Autumn

"China's most glorious floral gift to the West," the chrysanthemum, is emblematic of autumn. It is the symbol of joviality and is commonly associated with wine and poetry

By Mabel Irene Huggins

It seems just as likely, however, that the chrysanthemum is the flower of joviality because of a different association. In the West there is the hackneyed trio "wine, women, and song"; but in China the age-old companions of wine are poetry and chrysanthemums. The Chinese poet sits on the sunny southern side of his house on a chilly day in late autumn – and what are his pleasures? A pot of hot wine and his yellow or white chrysanthemums beside their wattle fence. Here is the truly jovial mood.

The cultivation of the chrysanthemum, like that of the peony, extends far back into the long-past centuries. Fully fifteen hundred years ago the poet T'ao Ch'ien (A.D. 365 - 427), in preference to being a magistrate, raised chrysanthemums in his garden. And ever since, China's poets have kept alluding to T'ao Ch'ien's enviable existence—his life of solitude and freedom from the affairs of the world. Their ideal is a quiet hut, such as he built, with the accompaniment of wine and chrysanthemums.

Twentieth-century Chinese chrysanthemums have as their ancestors *Chrysanthemum sinense, C. coronarium, C. indicum,* and *C. morifolium,* which are natives of China. But before these wild flowers attained their present development, they were subjected to the horticultural alchemy of a long line of Chinese gardeners, wonder-workers who produced the results that modern chrysanthemum fanciers have shown in their annual exhibitions throughout recent years. Anyone who has had the good fortune to attend such a show in Peiping knows the unbelievable diversity of form and color that has been displayed in those rare and priceless collections.

For their innumerable varieties, the Chinese have drawn upon their descriptive powers in the selection of appropriate names. There is a graphic quality about them that makes it easy for us to imagine the appearance of the "Crimson Pearl" and the "Yellow Ball" and the "Golden Hook" and the "Dragon's Eye."

Not only does the chrysanthemum play an important role in the spiritual life of China, but it is also utilized in food and has a share in *huo-kuo,* an extremely exotic concoction which is popular in Peiping restaurants. A charcoal-burning Chinese dish, which is a metal bowl with fire burning in its center, is filled with steaming chicken stock and placed in the center of the table. Thin slices of various meats, together with spinach and Chinese cabbage, are added to the hot broth, and the

➤ LIFELIKE CHRYSANTHEMUMS in natural colors serve as the decoration for this cloisonné vase

A.M.N.H. photo

bowl is allowed to simmer. When it is almost done, curly, fluffy white chrysanthemum petals are sprinkled into the boiling soup, which is ready to be served an instant later.

Each of the "four season flowers" has had a prominent part in the arts and crafts of China. Not only have they inspired artists and poets, but they have provided motifs for the decoration of many household objects. The craftsman often shows the spirit of the true artist in his feeling for what is appropriate, as in the use of the chrysanthemum to adorn a pewter wine flask.

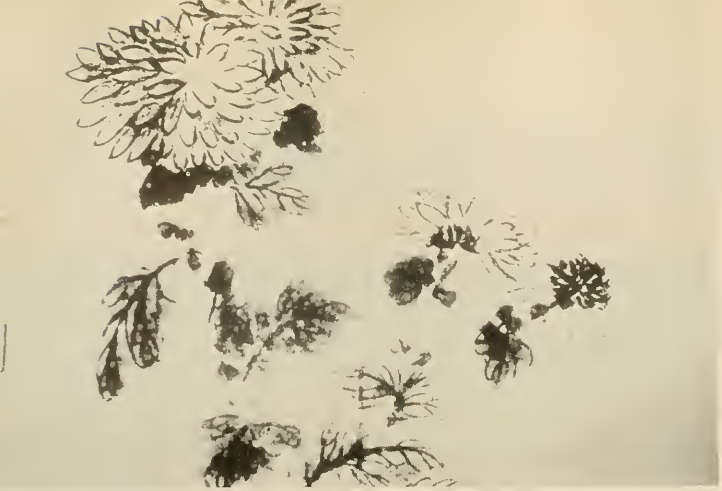


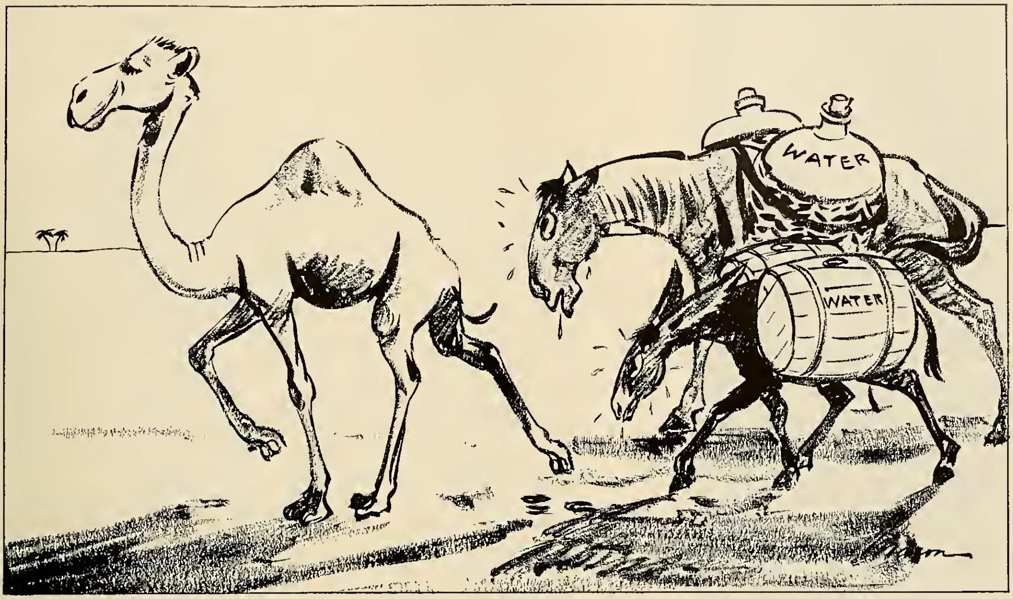
Photo by Corliss Hathaway

▲ CHRYSANTHEMUMS are a much loved and difficult subject for the Chinese painter's skill. By Chian Ting-hsi, A.D. 1669-1732

▼ IT TAKES little imagination to recognize that the design for this jade dish originated in a superbly beautiful chrysanthemum blossom. Ch'ien Lung period (A.D. 1735-1795)

Courtesy, Seattle Art Museum

BUILT-IN KNAPSACK



By John Eric Hill
Drawing by
G. Frederick Mason

WE are all familiar with the camel in zoos and circuses, but it still remains a curious beast. And not least peculiar is its hump, single or double as the case may be.

Unlike the hump of the bison, which contains mostly bone and muscle to support the massive head, the camel's hump simply lies beneath the skin of the back like a built-in knapsack and contains only fatty connective tissue. Connective tissue is the stuff resembling spider web that ties together and sheathes the various organs and attaches the skin to the muscles and bones beneath. When more food than is needed is taken in, much of the excess is laid down as fat in this connective tissue.

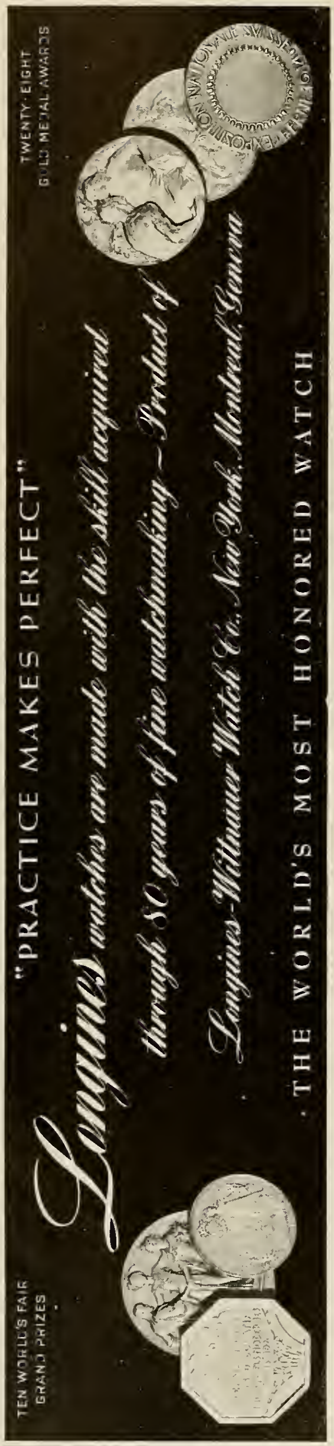
The Arabian camel's hump contains as much as 80 pounds of pure fat. This is food enough for about 10 days' hard work if all of it could be made available to the body so rapidly, and it is a welcome addition to scanty browsing on a long journey.

There is much popular misunderstanding about the amount of water the "ship of the desert" needs and how he carries it. Camels need almost as much water as horses. During the dry season they drink about five gallons a day, even when not working. But when forced to do without, they have performed remarkable feats of endurance. There are records of their marching 34 days and covering 530 miles without a drink. Only a few camels survived this ordeal, but many have carried the standard load of 400 pounds 25 to 30 miles a day for eight days without water. After such a dry spell, the camel is likely to drink as much as 20 gallons at once. However, camels do not need to drink any water during the wet season when they can browse at leisure upon moisture-filled forage.

Since the time of Pliny's *Historia Naturalis* in the first century, books have said that the camel stores its water in two pouches opening off the first chamber of the stomach (the rumen). Folklore, on the other hand, tells us that the hump contains water just like a tank or canteen. Neither explanation is correct. The pouches do sometimes contain almost pure water, but they cannot hold enough and appear only to draw water from other parts of the body to moisten the food undergoing digestion. The general supply of water is stored in the muscles and especially in the connective tissue.

The amount of water a camel can store depends largely on the amount of salt he gets. If plenty of salt is supplied, a thirsty camel with shrunken body and wrinkled skin will swell as it drinks almost as if it were being inflated by an air pump.

The "animal starch" or glycogen, stored in the muscles, and the fat in the hump also provide water indirectly. When these are used by the body as energy, water of equivalent weight is produced. Thus the fat of the hump, independent of the water in the connective tissue, makes some eight gallons of water. It seems on this score that folklore, while not exact, has been nearer the truth about the camel's hump than the learned authorities who, to the present day, have generally repeated Pliny's story about water being stored in the stomach.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TWENTY-EIGHT GOLD MEDAL AWARDS

TEN WORLD'S FAIR GRAND PRIZES

A Monarch Emerges

By Peter A. Carey

Photographs by the author

We have often heard of the life cycle of insects, with peculiar emphasis on that of the butterfly, since it is one of the most beautiful examples of this metamorphosis. Seldom, however, does such an opportunity for a graphic illustration of this wonderful process present itself as that which was opened up to me recently.

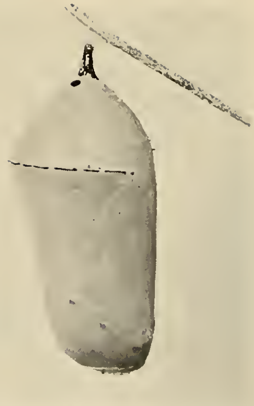
I took these photographs of the Monarch Butterfly, *Danaüs archippus,* to illustrate its development from the time of the chrysalis stage to full adulthood. The total period covered by the pictures is approximately three weeks.

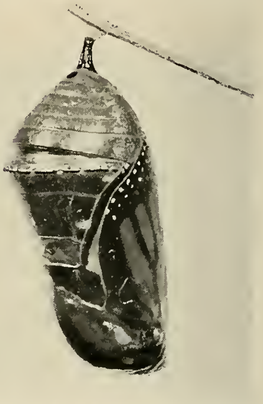
When I first found the chrysalis in the woods and brought it home, it was a light green color with an encircling gold line. During the three-week period, however, it gradually turned a dark brown—almost black. After noticing this, I discovered one evening that the top of the chrysalis had started to crack, and I realized it was about to hatch.

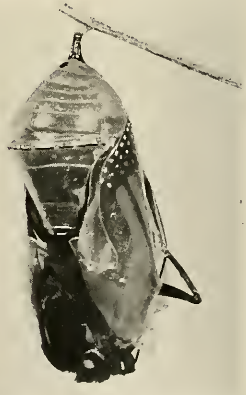
I placed one floodlight close to it, and the heat caused the butterfly to hatch more quickly. I set up my camera and proceeded to take the pictures; it was then 8:00 P.M. I continued to take pictures until 12:00 midnight.

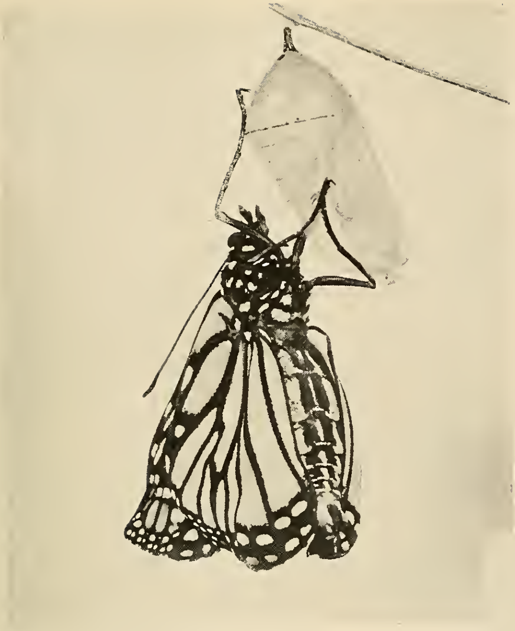
When the butterfly first emerged from the chrysalis, its wings were quite wet and not very full. Gradually it began to flap them and blow them up to full size. It then tried to get a better footing by climbing over the chrysalis to the twig, but when it reached the twig, it fell off, and the rest of the drying process was accomplished on firmer support.

When it fell off the limb, it was practically dry. After I had placed it on more stable footing, I realized that here was, indeed, a truly fine representative of his species—an adult monarch butterfly, one of the most beautiful of insects.


▲ The light green chrysalis as it was originally found in the woods

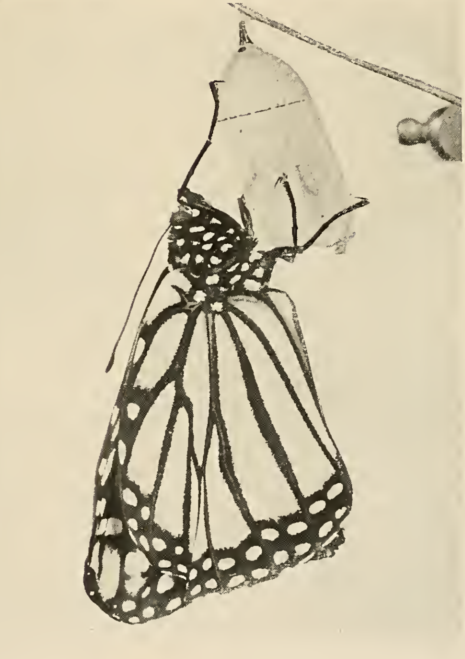

▲ After three weeks it had turned dark brown—almost black. Here it has started to crack

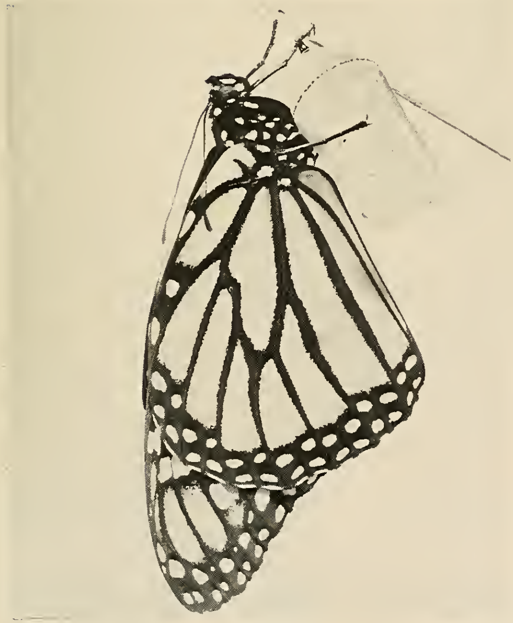

▲ Emergence. The Monarch struggles free to take its first look at the world



◂ AT FIRST, the butterfly's wings were quite wet and not very full

▾ FLAPPING ITS WINGS, it blew them up to full size





◂ JUST BEFORE IT FELL off the twig the mature Monarch Butterfly was almost dry—a magnificent specimen

LETTERS

Continued from page 345

opened slightly when it is hissing, and doubtless the noise serves to alarm the enemy.

People sometimes get mistaken notions about the vocal powers of snakes if a bird happens to burst into song precisely at the moment a snake is seen with its mouth open. The sounds produced by many birds have a pronounced ventriloquial quality, so it is very easy to suppose that the melodious trill is emerging from the snake. The same illusion is part of the stock in trade of such expert showmen as Edgar Bergen; when Charlie McCarthy's lips move and Bergen's do not, it is hard to believe that Charlie is not talking.

Mexicans in Sonora attribute a sort of whistling noise to the native moccasin, and Ivan T. Sanderson in his book, *Animal Treasure,* attributed a "dreadful crescendo whistle—that might have been a really powerful fog-horn," to a relatively small lizard, which he termed a "whistling skink." But the more careful naturalists, those who prefer to verify their facts before making unqualified statements, have not reported any vocalization or whistling in snakes. Crocodilians bellow, and many geckos produce sounds varying from barely audible squeaks to chirping noises that in chorus have repeatedly been described as deafening. The specific name of the South African fringe-footed gecko is *garrulus* for good reason. But I am afraid that the bull snake's abilities have always been restricted to a glorified hiss.

Charles M. Bogert,
Department of Amphibians and Reptiles.
American Museum of Natural History,
New York, N. Y.

* * *

Sirs:

I have heard that there is a species of deer that does not shed its antlers, and I would like to know more about this deer. Just what country or countries does this animal come from? It evidently is not a native of North America, as I have a history of all the animals of this continent and there are no deer listed in this book that do not shed their antlers annually . . .

C. E. Farrar.
Pueblo, Colo.

The following information is offered by George G. Goodwin, of the American Museum's Department of Mammals:

From the number of inquiries on horns, and more especially on antlers, it would seem that the average layman is more perplexed on this subject than almost any other wildlife question. This is not surprising, since it entails a strange phenomenon that is puzzling even to those well-informed on natural science.

Horns, in the broadest meaning of the word, are hard, excrescent growths on the heads of animals. They are used as weapons or they may be purely ornamental. In function, therefore, the "hollow" horns of the cattle, sheep, goats, and antelopes may be compared with the solid horns (antlers) of the deer. Solid bone antlers are characteristic only of the deer family, including elk, moose, etc. Only the males have them, except in the case of the caribou, where both males and females have antlers.

There is no deer in the world that does not shed its antlers every year. What this shedding means to the animal is more fully appreciated when it is realized that even the great antlers of the elk or wapiti and the enormous ones of the giant moose are manufactured and discarded each year. Imagine the tremendous drain on an animal's vitality when it must annually feed and sustain growing tissue that in a few months produces up to 60 pounds of solid bone. Every year, as regularly as clockwork and regardless of size, the old antlers are automatically dropped. Almost immediately a soft, spongy bulge of fur begins to swell in

Furred and Four-Footed QUIZ

By Elizabeth Eicher

Everyone is probably familiar with the expression "a laughing hyena," but do you know *when* he laughs? This and other interesting questions are brought out in this quiz on animals—familiar animals that you've seen in zoos, and perhaps even in their native homeland.

Scoring: 14 or over—excellent 11-13—good 7-10—average
Fewer than 7—well, we won't go into that.

1 The hyena laughs when he is:
A. *mating;* B. *in danger;* C. *in search of food;* D. *sad.*

2 A naturalist on the lookout for a manatee might go to the:
A. *Andes Mountains;* B. *California coast;* C. *Arctic islands;* D. *Peninsula of Florida.*

3 Which industry utilizes a product of the sperm whale's alimentary canal?
A. *plastics;* B. *perfume;* C. *rubber;* D. *papermaking.*

4 The perspiration of a hippopotamus is:
A. *colorless;* B. *yellow;* C. *red;* D. *white.*

5 At birth, the baby of even the largest species of kangaroos is approximately:
A. *an inch long;* B. *six inches long;* C. *nine inches long;* D. *one foot long.*

6 A baby elephant at birth weighs:
A. *30 pounds;* B. *50 pounds;* C. *100 pounds;* D. *200 pounds.*

7 An elk's or moose's "bell" is:
A. *a long flap of skin hanging from the throat;* B. *the hair on his tail;* C. *his mane;* D. *his mating call.*

8 The giraffe has one of the longest necks in the animal kingdom. How many more bones has he in it than you have in yours?
A. *20;* B. *10;* C. *5;* D. *0.*

9 The silky hair that is woven into a Kashmir shawl comes from a:
A. *gazelle;* B. *musk ox;* C. *goat;* D. *Barbary sheep.*

10 A Painter is another name for the:
A. *wild cat;* B. *leopard;* C. *puma;* D. *lynx.*

11 The kind of monkey usually kept by organ grinders is the:
A. *Barbary ape;* B. *rhesus;* C. *marmoset;* D. *gibbon.*

12 An animal spoken of as "plantigrade" is one which:
A. *walks flat on his feet;* B. *eats vegetation;* C. *cannot climb;* D. *hibernates.*

13 Ermine is the fur of:
A. *a lemming;* B. *a northern stoat;* C. *an Arctic fox;* D. *an aardwolf.*

14 Spermaceti, which is used in making candles, comes from what part of the sperm whale?
A. *blubber;* B. *muscles;* C. *cells in the skull;* D. *bones.*

15 The largest ape is the:
A. *chimpanzee;* B. *gibbon;* C. *orangutan;* D. *gorilla.*

16 The largest rabbit, 36 to 39 inches from nose to root of tail, is the:
A. *Arctic hare;* B. *Flemish Giant;* C. *common hare;* D. *jack rabbit.*

Correct answers on page 392

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the empty place. These bulges, carrying a full circulatory blood system, expand rapidly and take the form characteristic of the antlers of the particular species. Growth of the antlers continues until the final dimensions are reached; up to that time they are covered with fur or "velvet." When maturity is reached, the supply of blood and nourishment ceases, the antlers harden to their normal bony consistency, and the velvet peels off.

As already pointed out, antlers can be called horns, in the broadest meaning of the term. In the stricter sense, however, horns are *permanent* epidermal structures, made of the same cutical stuff as claws, fingernails, and hoofs, whereas antlers are bony and *deciduous,* or temporary. Sometimes the term "hollow horn" is used to distinguish true horns from antlers. Actually the true horn is a horny sheath that encases a bone core, and is not literally hollow. Animals with true horns retain them throughout life, with one exception. The American pronghorn sheds the horny sheath, and a new one grows over the bony core.

The horns of the giraffe are covered with skin and hair. Another peculiar type is the horn of the rhinoceros, which is specialized growth composed of agglutinated hair.

What happens to shed antlers? The theory that deer bury their discarded antlers is erroneous. Antlers grow quickly and disintegrate more rapidly than normal bone. Few, however, are permitted to decompose; most are chewed up by rodents for their calcium content, and even the deer themselves eat them—especially in regions where the water is deficient in bone-building material.

* * *

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* * *

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Insects in the House

SILVERFISH

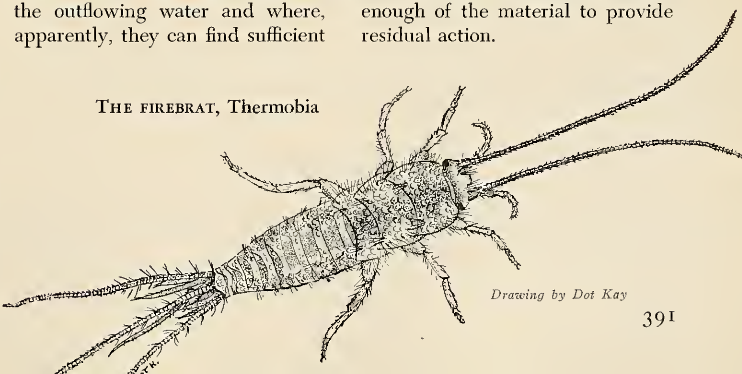
By C. H. Curran

Associate Curator, Department of Insects and Spiders, American Museum of Natural History

If left alone, Silverfish can do a perfect job of stripping wallpaper off the wall or destroying the binding of books. They do this because they are extremely fond of starchy foods and the paste provides them with an abundant supply. Quite often, too, they damage starched clothing and linens. In their attempt to obtain starch, they bite into the fibers; and while they seldom chew all the way through cloth, they do weaken it so that holes develop after the material has been laundered a few times. New cloth with plenty of the "sizing" still in it is most subject to attack, and bales are frequently severely damaged by insects feeding along the folds.

While silverfish may be present in the house all the year round, their numbers frequently increase in the fall, when they are attracted into buildings by the warmth. During the day they hide in dark corners, coming out at night to feed. Sometimes they establish themselves in the drains of bathtubs where they can find shelter from the outflowing water and where, apparently, they can find sufficient food for their needs. Two common kinds may be found in houses in North America, the common silverfish *(Lepisma saccharina)* and the Firebrat *(Thermobia domestica).*

Several methods of control have been recommended for silverfish. One way is to make a paste by adding a level teaspoonful of sodium arsenate to a cupful of flour and a little water. Small dabs of the paste are placed on paper butter patties and scattered about where the insects occur—behind books and in dark corners. Where there are pets or children, the poisoned paste must be kept out of reach. A second method is to spray the edges of rooms with one of the standard commercial mixtures containing either pyrethrum or rotenone and DDT. This should be applied so that the surface of the treated area glistens in the light. This spray will leave a residue that should be effective for some time. A third method, and one which the writer has found to be most effective in heavy infestations, is to use a pyrethrum-DDT aerosol bomb at the edges of the floors of all rooms. This kills the silverfish immediately, and if applied liberally leaves enough of the material to provide residual action.



The firebrat, Thermobia

Drawing by Dot Kay

Do Not Miss

Less than 100 of one of the tallest and most fascinating birds in North America remain alive in the world today. Although it lingers on the brink of extinction, a strong attempt is being made to preserve this all-but-lost species, and the co-operation of the public is earnestly sought. Read about it in CAN THE WHOOPING CRANE BE SAVED? by Lealon Martin, Jr., in the

November

Natural History

In the same issue, Schuyler Cammann will tell the unique story of his experiences in the tents and temples of the Mongolian lamas while on a special mission to inner Asia.

You will want to visit the Central American republic nearest to Panama when you read of the remarkable volcanic wonders to be seen there in Hobart E. Stocking's ACTION IN COSTA RICA.

Did you know that man has employed ants to stitch wounds together, monkeys to gather fruit, and beetles to illuminate jungle trails? Do not miss these and many other strange uses for animals in a coming article by the British nature writer, Frank W. Lane.

Eighty-two years ago a strange yellow bear was killed in Canada's northern "no man's land." Since then not another one like it has been seen. Does this curious creature still roam the Barrens, or was this the last of its line—possibly the nearest modern relative we shall ever know of the extinct giant bears of long ago?

THE AMERICAN MUSEUM
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WILD PIGS OF THE DESERT

Continued from page 355

sister, as the case may have been, frequently dashed off in the opposite direction when the pursuit was under way. The two infants did not attempt to stay together. A rancher who said he had observed a mother peccary with "a whole litter of little pigs, at least twelve in number," must have been slightly confused. On the six occasions when collared peccaries have bred in the Bronx Zoo, the number in each litter never exceeded two. The wild piglets have been seen at various times throughout the year, indicating that there is no particular season for birth.

I found still another peccary in the locality I visited, a full-grown individual that came to call on the tame pig on rare occasions. The visitor, known soon as "Blackie," presented a real contrast to the little gray animal, because he was entirely black except for a light-colored "collar." The gray pig, christened Winnie, also had a trace of the collar, this marking being typical of the species. Blackie was not a pet and why he chose to leave his wild brethren to visit the comparatively civilized surrounding, I could not fathom, nor could anyone tell me. He would appear and disappear with no particular regularity, and while he would permit fairly close approach, he did not encourage undue familiarity.

A herd of peccaries remained in the general neighborhood but were never seen by anyone in the immediate vicinity of Joe's house. Joe and his wife would sometimes see them when driving into town or when abroad on some other errand. The animals were perfectly wild, yet no one ever knew them to molest a visitor in any way. There was no hunting permitted in the 50,000-acre region surrounding the house.

This acquaintance with the little pigs of the desert was, in itself, satisfactory, but I still wanted to see a group of the animals under conditions that had no trace of civilization whatsoever. Finally, after a long wait, another friend and I were driving near the Santa Rita Mountains early one evening. To my great delight, there suddenly appeared a collection of nine peccaries, trotting across the road not more than 200 feet in the front of the car. They continued on their way through sparse growths of mesquite and were in good view for some minutes. There was an old boar, accompanied by several sows, and in the wake of these three, an assorted group of animals in various stages of development. I got out of the car and followed slowly, but the animals only increased their speed and vanished.

Like all other wild creatures I have ever encountered on their native heath, the peccaries were interested only in their own affairs and were only anxious to escape from human interference. I reflected that even a woodchuck or a raccoon will do battle, with great courage and fortitude, whenever cornered or otherwise faced with the necessity of combat. It is not at all unreasonable to believe that a peccary would do the same thing. But from what I could learn, it is a shy, though sturdy and self-reliant animal, which does its best to exist despite the inroads of man upon its terrain, annual hunting seasons, and ingrained prejudice. Nowhere could I find anyone who had been actually injured by the peccary, not to mention killed by one. The animals become gentle, trusting pets, and to encounter one under any conditions is a naturalist's good fortune.

ANSWERS TO FURRED AND FOUR-FOOTED QUIZ

on page 390

1 C 2 D (A Manatee is an aquatic herbivorous animal with a broad, rounded tail. 3 B (ambergris)
4 C 5 A 6 D 7 A 8 D
9 C 10 C 11 B 12 A 13 B
14 C 15 D 16 B

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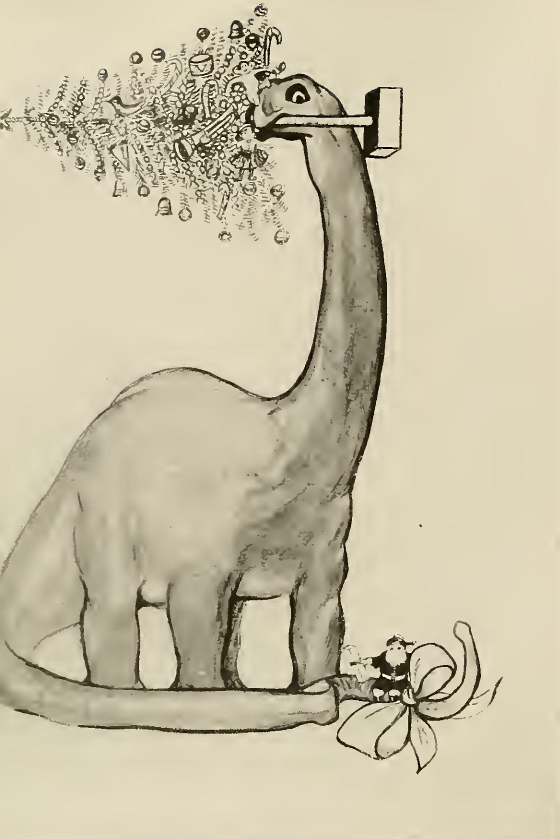

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May	Canvasback	*November*	Valley Quail
June	Upland Plover	*December*	White-fronted Goose

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April	Passenger Pigeon	*October*	Canada Goose
May	Hybrid Flicker	*November*	Osprey
June	Blue Jay	*December*	Blue-winged Warbler

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March	Summer Tanager	*September*	Catbird
April	Band-tailed Pigeon	*October*	Canada Jay
May	Carolina Paroquet	*November*	House Wren
June	Mourning Dove	*December*	Yellow-breasted Chat

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LETTERS

Sirs:

I always look forward to the arrival of Natural History, for it is one of my favorite magazines because of its interesting, well-written articles and its distinguished photography.

The other day I witnessed a strange thing. It was about 6:30 in the evening when I saw two cottontails on the lawn and decided to watch them. One of the dusky little shadows gave a graceful hop straight up into the air. From points three or four feet apart, the rabbits hopped in a circle, then approached each other, and one would sail up perpendicularly while the other dashed under him so that when the first one landed the distance betweeen them was again three or four feet. This graceful leapfrog game was played alternately, first one hopped over, then the other. Now and then both would "freeze" for a second, or one or the other in a seeming excess of high spirits would give an extra hop, high and straight up so that his hind legs were stretched out beneath him, and his spoon ears poked straight up above him. They seemed not to make a sound and the whole effect was entirely effortless and gay.

Is this a common thing? The rabbits seemed to be performing a sort of ritual or game that had been planned in advance. It lasted three or four minutes (although it seemed longer as they repeated the movements of the game many times), and it had a definite pattern and rhythm. It was so lovely that I wish they would dance on our lawn every evening.

Florence Volk.
Dallas, Texas

The following information is offered by John Eric Hill, of the American Museum's Department of Mammals:

This "dance" of cottontails Miss Volk witnessed must be unusual, for it is not recorded in the various natural histories. There is behavior somewhat similar in the varying hare. J. Dewey Soper, writing in *Field & Stream* (March, 1917, page 396), reported a gathering of these animals one moonlight night at which they frolicked and played. Both occurrences may well have been related to breeding and might represent a courtship play, as in some birds.

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Soaring Flight—a photographic study by S. R. Ramsey

Sirs:

A few days ago you sent me some literature describing your magazine Natural History, and I thought that it would be just what my children, who are in school, would need to keep them informed on up-to-date things and events. . . . The first copy arrived yesterday, being the issue for September, 1946.

In looking through the magazine last night, I noticed on pages 342 and 343, the letter on Science and Religion and the answer to it by Dr. George Gaylord Simpson . . . After reading his statements about evolution, I decided that I did not want such a magazine coming into my home for my children to read. Please *cancel my subscription immediately*. Enclosed is a money order for fifty cents, which is the regular price for a single copy of the magazine.

It is too bad that you are holding on to those "old fogey" ideas about evolution . . . If you expect to hold the attention of the modern generation, *which is thinking for itself*, you will have to stop publishing such lies as those in Dr. Simpson's article.

Delmar H. Bryant.
Big Prairie, Ohio

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $2.00 each, with full credit to the photographer. Return postage must be included.

Dear Dr. Simpson:—

Your answers to the letter printed on page 342 are, in my humble opinion, inspired. They must represent hours of careful thought on your part. May I tell you the time was well spent? I read it to my husband last night. He said, "That is a master stroke. Thank you for reading it."

Continued on page 440

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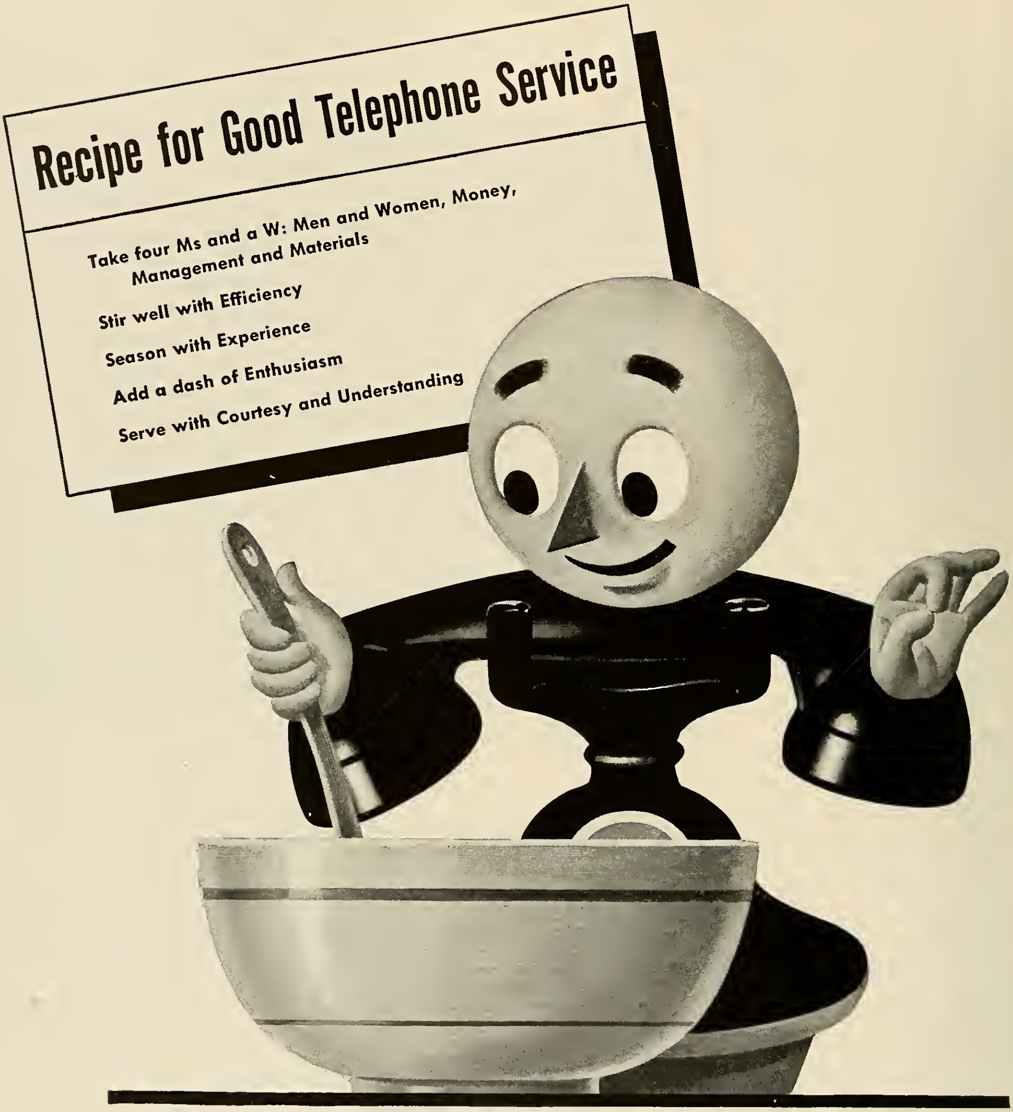

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President   ALBERT E. PARR, Director

VOLUME LV—No. 9   NOVEMBER, 1946

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From a Kodachrome by Thomas Peters Lake

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One of the most curious plants of the tropics

THE COVER THIS MONTH

The autumn scene was photographed in the southern edge of the Catskill Mountains by Thomas Peters Lake, with a 4 x 5 view camera.

Many persons believe that leaves acquire their autumn coloration by the addition of some new pigment through the action of frost. This is not so. The brown, red, and yellow pigments are already in the leaf, and these become evident when the onset of colder weather destroys the green pigment. Cold weather without frost is adequate to cause this change and to bring out the various permanent colors in the leaf. The amount of these different pigments varies in individual species. Therefore some trees turn yellow, others turn red, and some the color of bronze.

Autumn coloration as we see it in northeastern United States is one of nature's most gorgeous displays. Tropical landscapes lack any comparable spectacle, for they do not have the temperature changes or the kind of trees that respond in this way.

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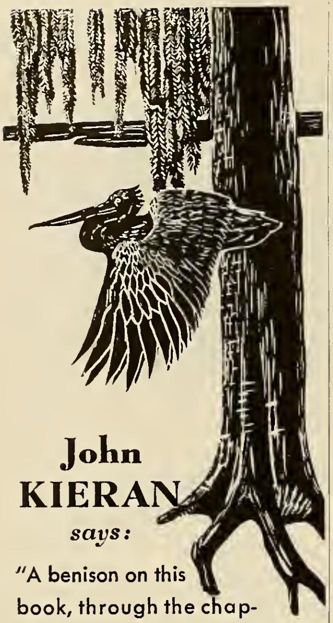

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THE modern museum and the modern encyclopedia were born at about the same time. Who would deny that they have had a vigorous growth? More and more their problem has been one of intelligent selection based upon the needs of our complex and changing life. In a sense, their value to mankind can be measured by their ability to keep up with the changing world. Man himself is the priceless ingredient in the running of a museum or the editing of an encyclopedia.

Museums and encyclopedias are but two of the aids we use in conquering our environment and in learning to live happily and successfully in the world we have created. These two important cultural weapons in the fight against ignorance have much in common.

Compton's can be congratulated on the strong staff of experts and educators who have contributed in the production of its latest endeavor, the 1946 edition. They have handled the difficult job of selecting material in an excellent manner, keeping well in mind the function which was its chief aim, namely, to furnish for children and parents the expert guidance they need in "putting together the facts of a jumbled world!" The editors have tried to keep in constant touch with the changing needs in the school-library field and to keep *Compton's* abreast of the requirements of those who use it.

Its fifteen volumes, well-bound and printed on good paper, abound with excellent gravures, black-and-whites, and a generous allotment of direct color photographs and stimulating drawings, diagrams, and maps. There is a great deal of new material in this edition, and one is amazed to find topics that were seemingly headlines just a few months ago. Especially well treated are the natural and physical sciences. The American Museum's friends and staff should be pleased and flattered to see the numerous illustrations from the exhibitions in our halls and in the halls of other great museums in our land.

The thousands of pictures in the set, many in excellent color, were selected from a stock of over 750,000. This tremendous task of selecting the very best pictures for each purpose from this collection shows substantial results.

This, lest there be misunderstanding, is not a profound or ponderous work. It is appealingly laid out, and the writing in the articles is brisk and entertaining without sacrificing accuracy. Adults and children will find the set a useful reference work, especially since each volume has a Fact-Index of its own which is, in itself, a veritable treasure-house of useful information. Included in the set, at strategic intervals, are study-outlines which serve amazingly well to develop larger and more basic topics by indicating cross-references to related articles in other volumes of the set.

Appealing to the eye and mind, these volumes invite browsing, as the reviewer can vouch from personal experience. To some this may seem a questionable virtue in that it would tend to distract the searcher for specific information and lead him off into the perusal of "greener fields" of enjoyment. To the reviewer, it is but an excellent indication of the degree to which the editors have succeeded in producing a world on a shelf that is both informative and intriguing.

JOHN R. SAUNDERS.

APES, GIANTS AND MAN

- - - - - by Franz Weidenreich

University of Chicago Press, $2.50

122 pp., 90 figs.

THE title of this book describes appropriately enough the general topics with which it is largely concerned. Professor Weidenreich has here gathered a few sheafs out of the rich harvest his distinguished scholarship has produced in recent years on the subject of human evolution. As Hitchcock Professor at the

Continued on page 398

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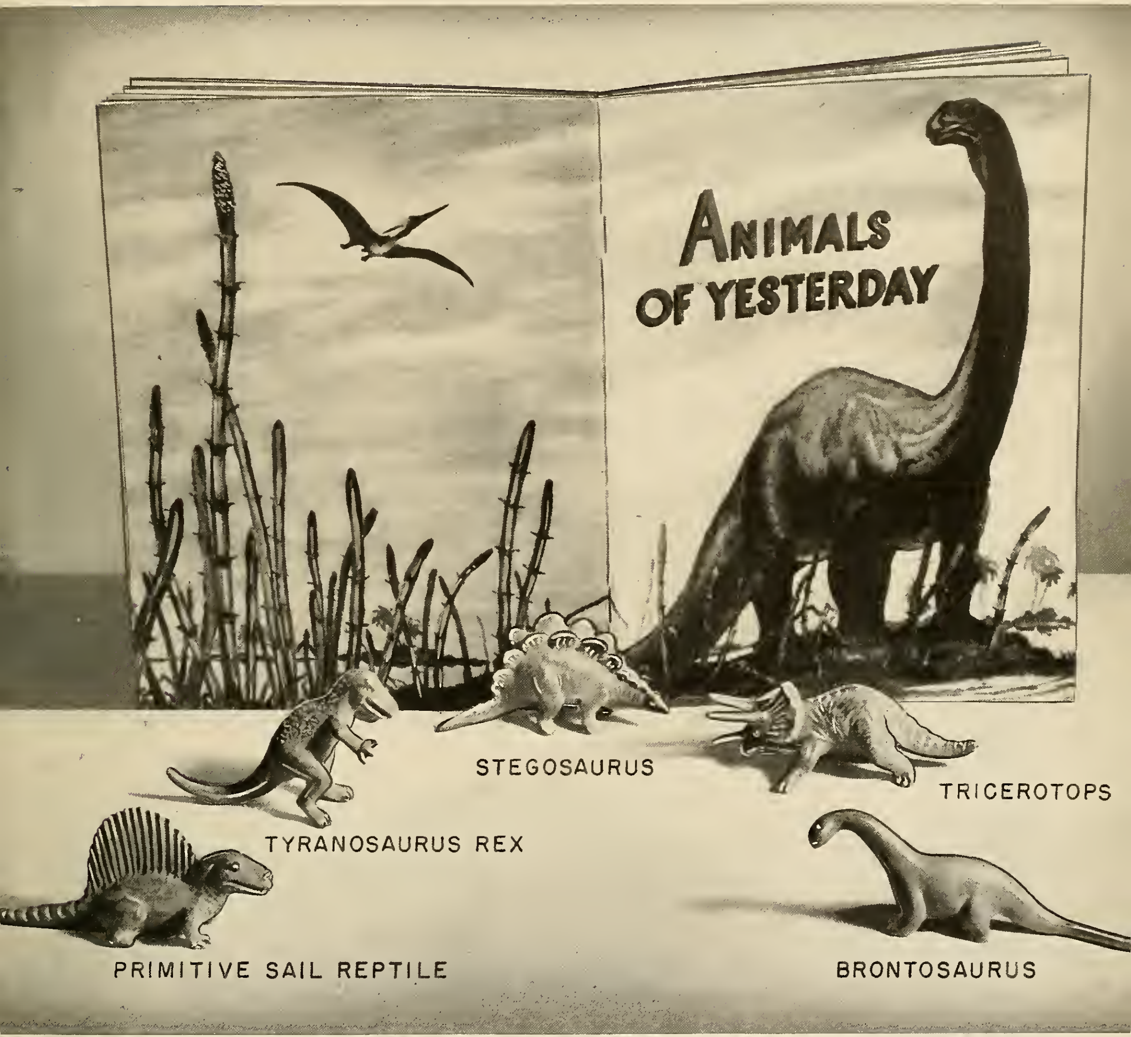
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University of California a year ago he delivered five lectures, which are now represented by the five chapters of *Apes, Giants and Man.*

Man's relationship to his closest relatives among the anthropoid apes is made clear in the first chapter. That relationship is one of cousinship with the living anthropoids rather than, as is commonly believed, of a more direct connection. Having disposed of man's "poor relations," Weidenreich then presents us with his most matured conception of the morphological changes that mark the evolution of man himself. He classifies the successive stages, marked by known fossils, into 10 distinct groups distributed in various parts of the world. He suggests that human evolution was going through parallel transformations in different areas and perhaps at different tempos. Here in a special chapter he presents in simple form the sensational evidence he has recently brought to light that the extinct forms of man were giant. The final chapters are concerned with the difficulties and frustrations of racial classification and the recent changes in the skulls of modern man.

There is no one today who speaks with greater authority on the subject of man's evolution than Professor Weidenreich. It is, therefore, a happy occasion to welcome this succinct and authoritative account of those phases of human development that he has elected to discuss in this book. Here is the last word on the earliest man.

H. L. Shapiro.

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ANIMAL TALES

An Anthology of Animal Literature of All Countries

- - compiled and annotated by
Ivan T. Sanderson

Alfred A. Knopf, $5.00
511 pages, 31 illust.

MR. SANDERSON, in his own right an author of a number of books about animals, has gathered together 31 interesting animal stories from nearly every corner of the world. The tales are introduced by a short account of the country in which each is laid and something of the flora and fauna, as well as a short biography of the author.

One story, "The Last Moon of Azu," is published for the first time. It is a dialect story told by a West African hunter and recorded by Sanderson. The other 30 tales are reprinted, often in somewhat shortened form, from the works of such writers as Alfred Russel Wallace, Jean-Henri Fabre, Felix Salten, "Grey Owl," Samuel Scoville, Jr., William Beebe, W. H. Hudson, Ernest Thompson Seton, and others, some not so well known. The various stories were chosen for their charm and effectiveness rather than for accuracy. In fact, they range from the fantastic and impossible to the truthful reporting of scientific observers who were also gifted with literary ability. Each is identified as to its nature by the editor.

The choosing of one story from the works of each author, to represent every kind of animal tale and every major geographical area, was doubtless a difficult task. It might be expected that the choice of the compiler would not always agree with the reviewer's opinion. For example, I can hardly believe that Buckland's account of the rats, sprightly as it is, is the best available example of British natural history. On the other hand, most of the selections are to be commended, and Kennion's story of gazelle-hunting in Persia, Steven's "Way of a Lion," Pratt's "Edward" (the Koala), Stroock's "Vicuña," among others, are worthy of a place in animal literature.

Most of the stories are about mammals, but birds, fishes, and arthropods are not completely neglected. Lack of space probably prevented inclusion of reptilian and amphibian stories.

The book is handsomely illustrated by brush paintings by Sanderson, one for each tale. The originals were on exhibition in the American Museum for some time and have attracted much discussion. The technique is excellent, but the accuracy of some of the drawings leaves something to be desired—as in the case of the white jaguar's head, the wolf's tail, Bambi's hindlegs, and others.

The paper, typography, and binding of *Animal Tales* are in the best tradition of Borzoi Books, and this is a volume that should find a place in the libraries of many nature lovers.

JOHN ERIC HILL.

IRAN

- - - - - - - by William S. Haas

Columbia University Press, $3.50;
257 pp., 10 illust.

IN view of the prominence of Iran in the news these days, an authoritative and interesting volume about that ancient land is overdue. In *Iran*, by William S. Haas, one finds both requirements met most admirably.

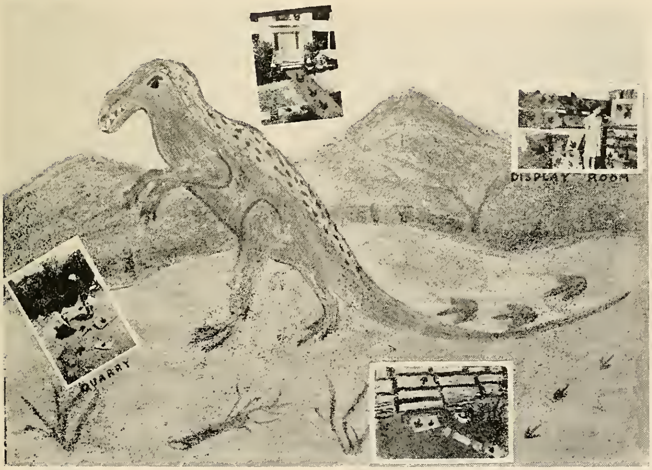
Not only did Dr. Haas live in Iran long enough to make his observations worth reading, but his residence there was such as to give him access to source material about Iran's history, people, and culture. For five years before coming to the United States in 1940 he was adviser to the Persian Ministry of Education. He helped organize the new university in Teheran and founded a museum of Persian ethnology and anthropology in the same city. His work in gathering collections for the museum took him all over the country. Since 1943 he has been associated with the Iranian Institute and School for Asiatic Studies in New York City.

In his opening chapter, Dr. Haas gives a brief and fascinating survey of Iran's long history, in which he does full justice to her many and varied achievements. Other chapters describe religion, society, government, Persian psychology, and the cultural and economic situations. Two more chapters are devoted to history, one to the reign of Reza Shah Pahlavi, and the other to the present outlook. Dr. Haas is at his best when discussing the racial background and traits of the various peoples of Iran. In view of the inclusion of the Armenians in this account, the reader is apt to wonder at the complete omission of the progressive and capable group of modern Assyrians who long have lived within the boundaries of Iran.

Especially suggestive and sympathetic is his discussion of Sufism and the place it holds in the religious life of Iran. He points out that in Persian Sufism "beauty and light predominate as the attributes of the divine essence," and he illustrates this aspect of Sufi belief by well chosen examples.

Perhaps Dr. Haas is unaware that since the abdication of Reza Shah Pahlavi the pendulum has swung back to such a degree that in many places an unveiled

Continued on page 439



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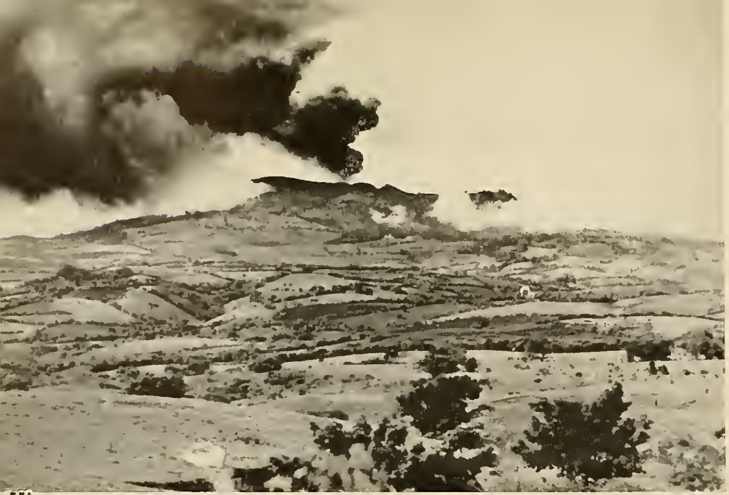


◂IRAZÚ in mild eruption in 1940. An ash-laden cloud of gas mounts skyward. The soil is so fertile that fence posts literally grow into trees; hence every field is outlined by them

By

HOBART E. STOCKING

State Department Visiting Professor, Department of Geology, University of Costa Rica

Photographs by the Foto Shop: Costa Rica

ACTION in Costa Rica

Costa Rica's volcanoes usually smoke quietly, but they occasionally cut up, spouting lava, laying waste to the countryside—and saluting presidents

COSTA RICA is a lively country in more ways than one. Politically it is believed by many to be far in advance of any other country in either Central or South America; geologically it is in constant ferment. It contains eleven volcanic cones, six of which are actively engaged in subtracting material from the interior of the earth and adding it to the exterior.

The total area of Costa Rica is about that of West Virginia, and the active cones are in the northern half. Six volcanoes located, say, between Charleston and Wheeling, West Virginia, would be no small feature of the landscape; and in Costa Rica, where the rich soil is frequently cultivated almost up to the smoking crater, volcanoes figure more than casually in the life of the people.

These cones are prominent peaks in the Western Cordilleras, which corrugate the two American continents from Alaska to Cape Horn. By the time the immense range reaches into Central America it is probing into cramped quarters, and a considerable part of Central America exists solely by virtue of volcanic heights sloping sharply westward to the white breakers of the Pacific or eastward to the Caribbean Sea. Orosí, the northernmost of Costa Rica's cones, smokes quietly within sight of Lake Nicaragua. To the southeast rise Rincon de la Vieja (active), Miravalles (active), Tenorio, Arenal, Viejo, Poás (active), Barba, Irazú (active), and Turrialba (active). Barrahonda, quite out of line, rises near the head of the Gulf of Nicoya.

The word "active," as applied to volcanoes, is relative. Some, like Mauna Loa in the Hawaiian Islands, work seven days every week, and their boiling lakes of molten rock, or magma, are spectacular sights. But in this sort of volcano, when the inner demons roll restlessly in their infernal beds, the resulting eruption is usually a relatively mild overflow of fluid, incandescent lava, peacefully pulled down the slope by gravity. Only incidentally does the molten rock engulf bits of civilization carelessly strewn in its path. Such volcanoes may suffer the indignity of having their eruption diverted by man-made dikes constructed for the purpose.

Other "active" volcanoes make no daily display of their internal power. Their craters hold no lake of fluid rock; there is only the dark orifice of the chimney, steaming quietly, sometimes intermittently. They are said to be dormant and may remain deceptively peaceful day after day, decade after decade, even century after century. But when their internal temperature and their content of magma and gas awaken to find themselves ripe for activity, no man of the past, present, or future could deflect their eruption.

Violent Volcanoes

In the South Pacific, Krakatoa is a classic example of this type of volcano. In 1883, after two centuries of silence, it threw a cubic mile of pulverized rock 17 miles into the air. The resulting sea-wave washed 36,000 lives from the shores of Sunda Strait; and the volcanic dust from the eruption made eight recognizable trips around the earth. Mont Pelée, on the island of Martinique, has a similar nature. In 1902, with but brief preliminary fuming, a blast of superheated gas shot from beneath the plug of solidified magma in its throat and snuffed out the lives of all but two of the inhabitants of Saint-Pierre, six miles away. One of the survivors provided an exception to the rule that crime does not pay—he was an inmate of the local bastille, and his dungeon proved to be a lifesaving refuge.

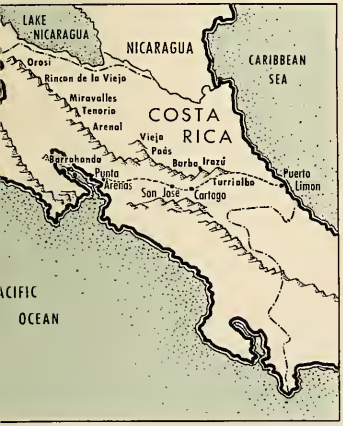
The volcanoes of Costa Rica are of the intermittently active type, and the cones and craters of many show unmistakable signs of long periods of dormancy broken by violent outbursts.

There are all gradations in the activity of volcanoes, from the spectacular but relatively passive overflows of lava at Mauna Loa to the stupendous outbursts of Krakatoa and Pelée. The violence of a volcanic eruption is related to the physical (and chemical) character of the molten rock, or magma, in the chimney. In general, there are three types of molten rock; those that are acid in composition, those that are basic, and intermediate ones. This classification is purely for the convenience of the geologist, and in reality there is every gradation from one type to another. One of the chief components of molten rock is usually silica (also a component of your windowglass). Even at the high temperatures encountered in volcanoes, silica is a stiff viscous liquid. In addition to the silica, magmas contain a sufficient quantity of other materials to render them relatively fluid. Basic magmas, such as those of Mauna Loa, are sometimes very fluid. The contained gases escape constantly from such a thin fluid, for the magma remains in a liquid state even after it has cooled considerably. From an acid or intermediate magma, in which the compounds that lend liquidity are less abundant, gas escapes with more difficulty. Such magmas, with lesser cooling, develop a crust beneath which the gas accumulates. In a year, a decade, or a century, the internal pressure of the accumulating gas surpasses the strength of the restraining congealed and semicongealed magma. Then there is a sudden and violent outburst, even one of Krakatoan or Peléean magnitude.

In the periods between infrequent eruptions, the volcanoes of Costa Rica are merely mountainous slopes supporting coffee *fincas* and dairy farms. Irazú, rising more than 11,200 feet, is not only the highest but also the most accessible of the active volcanoes. Local pride and a close eye on the tourist trade led to the construction of a paved road from San José, the capital, directly into the crater. Aside from thin and infrequent layers of lava, the bulk of the massive cone is built of fragments—blocks, lapilli, cinders, and dust. Clots of magma have been thrown upward during an eruption and, solidifying in the air, have fallen in the vicinity of the chimney, gradually increasing the stature of the cone.

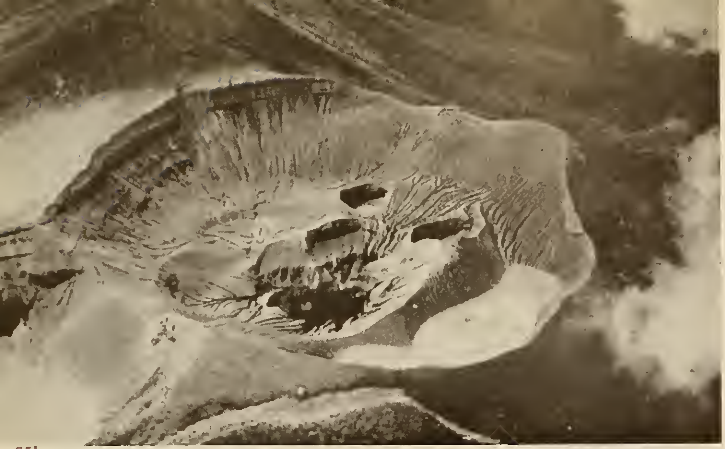
Ascending Irazú

The road to the summit of Irazú winds through tropical growth, some primeval, some cultivated, and mounts steadily into cooler at-

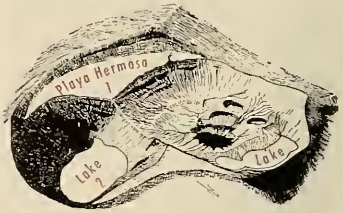


▲ MOST OF COSTA RICA'S ELEVEN volcanoes, six of them active, extend in a rough line southeastward from Lake Nicaragua

▼ THE SUMMIT OF IRAZÚ on a smokeless day. Water on one side flows into the Pacific, on the other into the Caribbean



THE CRATER OF IRAZÚ is as weirdly sculptured as a mountain on the moon. From the northernmost point of Playa Hermosa one can look down into the earlier crater (lower left in photo) which sometimes holds a shallow lake, and into the active crater (*center*)



mosphere. Abruptly, about a thousand feet below the crest, there is a change in the type of vegetation, and to the nonbotanical eye this section might have been transplanted from New Mexico. The crater itself, except for a few stunted cedars, is as barren and as weirdly sculptured as any mountain on the moon. During normal activity, Irazú sends up from its largest chimney a thin column of steam, pungent with sulphur dioxide. Infrequently there is an increase in tempo, and a cloud of ash-laden gas mounts skyward. In such a cloud, the sulphur dioxide gas from the volcano combines, as it cools, with water vapor, to form sulphuric acid. Acid-coated ashes frequently lay waste to fertile coffee plantations to the leeward. A wet season (April through November) is usually sufficient to wash the acid from the new covering of the soil, which after this cleansing is said to be even more fertile than before.

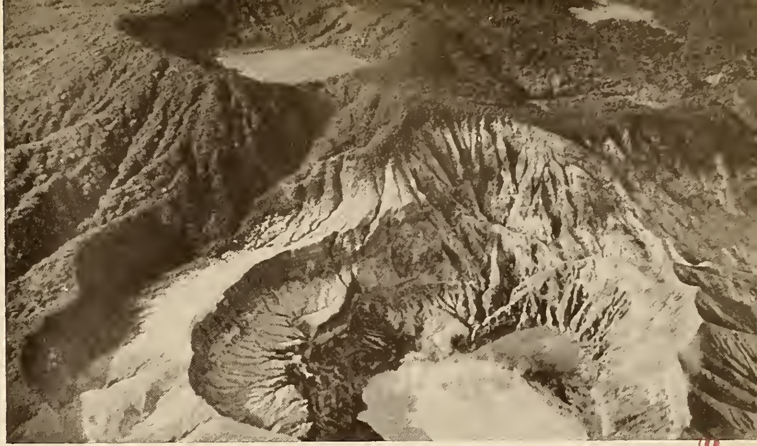
Sometimes a visitor may have as clear a view of the crater of Irazú as that shown in some of the accompanying photographs, and at such times the scars of earlier outbursts are clearly visible. The flat floor of Playa Hermosa is a remnant of an earlier crater whose profile was different from that of the present active orifice. From the northernmost point of Playa Hermosa, one may look down 400 feet into a second inactive crater which sometimes holds a shallow lake. From the same point it is 525 feet down to the largest of the chimneys in the active crater. In a region of more than 80 inches of rainfall, every basin is likely to contain water for at least short periods, and the craters, even the chimneys, of active volcanoes are no exception. From the edge of the playa one can catch a glimpse of deep topaz water within the central chimney when it is not steaming.

From the high point that rises immediately behind the playa the ordinary observer, on a cloudless day, may have the pleasure of looking across a continent—to the east lies the dim blue of the Caribbean Sea, to the west the faint line of the Pacific Ocean. Only a geographer is denied this thrill: his profession so sharpens his sight that he can see only across an isthmus that joins two continents.

Volcano Poás

Volcano Poás, to the north of Irazú, is not quite as high as the latter; its summit (8,895 feet) is well below the altitude of vegetation change. The paved road up this cone ends well below the edge of the moderately flat crest. If the trip is made on an early morning in the wet season, the ox-cart road from the end of the pavement to the crater will be a slippery struggle. The water-soaked trail will divide every stride by half, and the mud will hold one's foot as security for the remainder. The trail reaches the summit beyond the small light-colored area in the right

◄A CLOSE-UP of the smoking chimney of Irazú



➤ THE SUMMIT OF VOLCANO POÁS from the air. The active vent is in the foreground. An inactive, lake-filled crater is in the left background. The smaller area in the right background is another, partly overgrown

background of the view at upper right and slopes downward to pass through this clearing. This is a shallow basin, an inactive crater, now filled and partially overgrown with tropical vegetation. The frequent and heavy rains leave an ephemeral lake here which is quickly drained by seepage through the porous volcanic ash. In the left background is a second extinct lake-filled crater.

The denuded, fluted crater in the foreground of this photograph is the active vent of Poás. It, too, holds a lake, but it is an exceedingly restless one. Costa Ricans maintain that Poás is the largest "geyser" in the world. There is almost hourly evidence to support this claim: a preliminary burbling in the slate-gray water gives way to a sudden roaring spout of steam, mud, and water, as shown in the accompanying photograph. The mechanics of the action are indeed like that of a geyser, and the sight, even though it is dwarfed by the yawning crater, is a spectacular one.

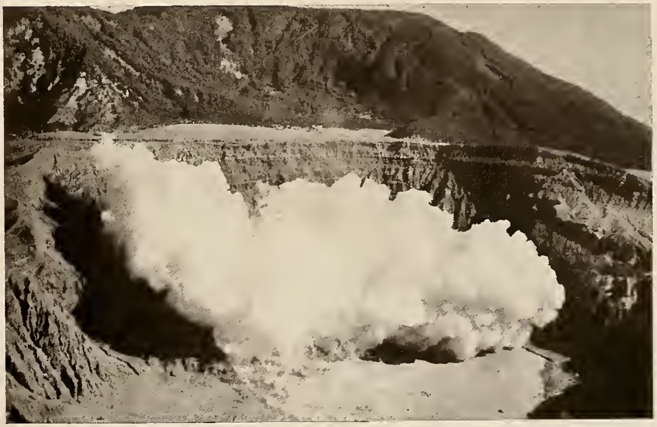
Poás is an unusual volcano, seemingly quite conscious of diplomatic amenities in a country where complete courtesy is a national characteristic. For the casual *tourista norteamericana* who has the endurance to walk or ride horseback from the end of the pavement to the crater (and there have been a hundred of them in blue and khaki every week end from the Canal Zone), this forge of Vulcan never misses a performance. But for a visitor of note, Poas can rise to the occasion with a prompt display of stunning power.

Vulcan's Salute

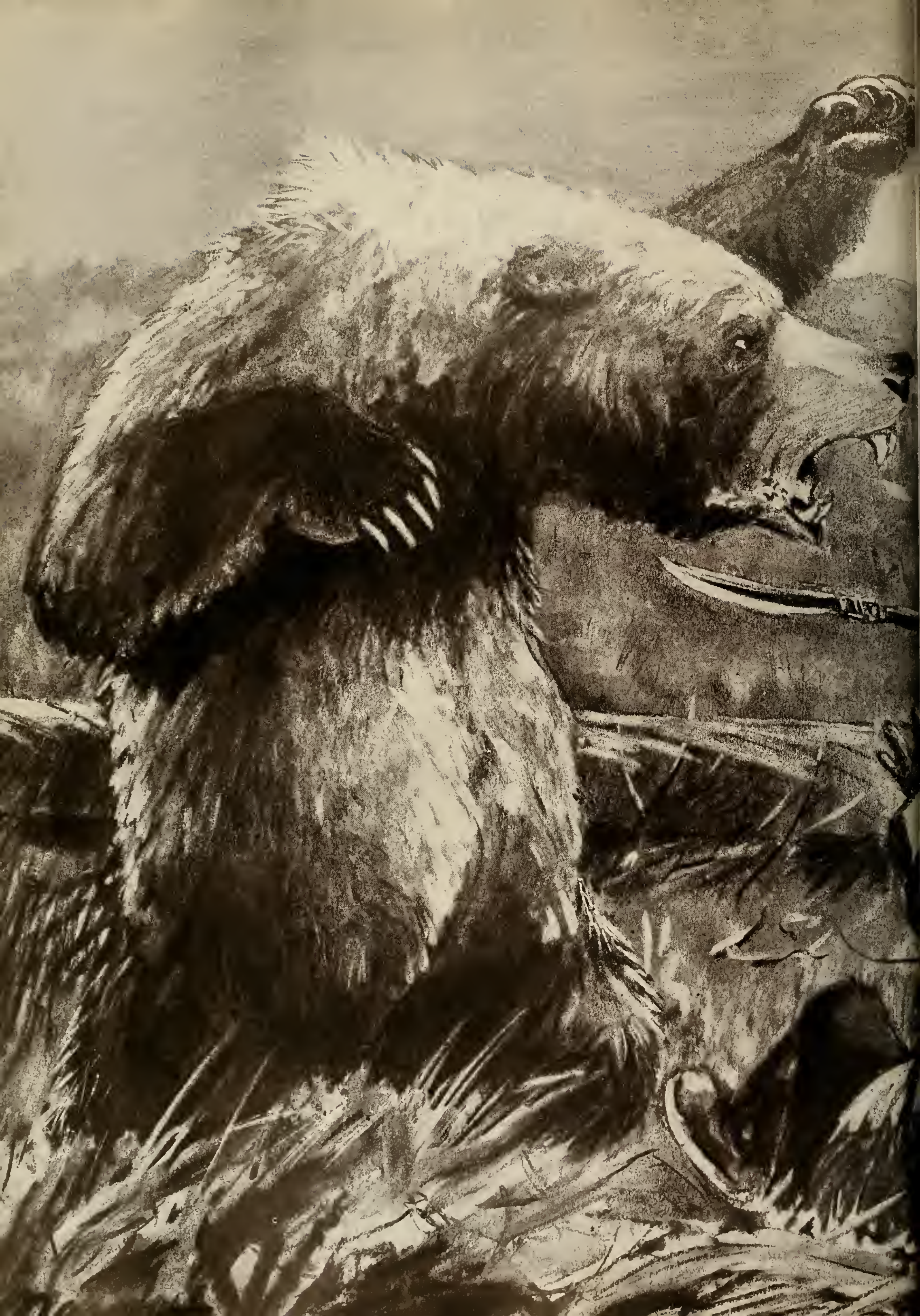
Not long ago Leon Cortez, then President of Costa Rica, led an inspection party up the slopes of Poás. It was the intention of the President to decide whether the paved highway should be extended farther up the cone and across the summit to the active crater. Reaching the end of the improved road, the presidential party continued by horseback, discussing with the engineers the feasibility of the project.

The head of a State, any State, merits a salute of 21 guns. Vulcan's artillery is neither the mobile nor the rapid-repeating type, and presumably there is no surplus of charges; but as President Cortez dismounted stiffly and stepped to the brink of the crater there was a stupendous roar. With the sound there rose from the lake a colossal black and white column of steam, water, and mud. As the unique outburst shot skyward, the astonished officials stared in amazement. It was not the ordinary eruption that Poás provides for common visitors; it was a salute of 21-gun presidential caliber. It was the only diplomatic recognition Vulcan ever accorded the head of any country.

That the highway was never extended to the crater of Poás was due to financial difficulties and not to an oversight of diplomatic formalities between Vulcan and the President of Costa Rica.



➤ ALMOST HOURLY ERUPTIONS cause the 7900-foot cone of Poás to be called the "largest geyser in the world." The crater is 1500 feet across and 600 feet deep, the water from 100°F. to 150°F.



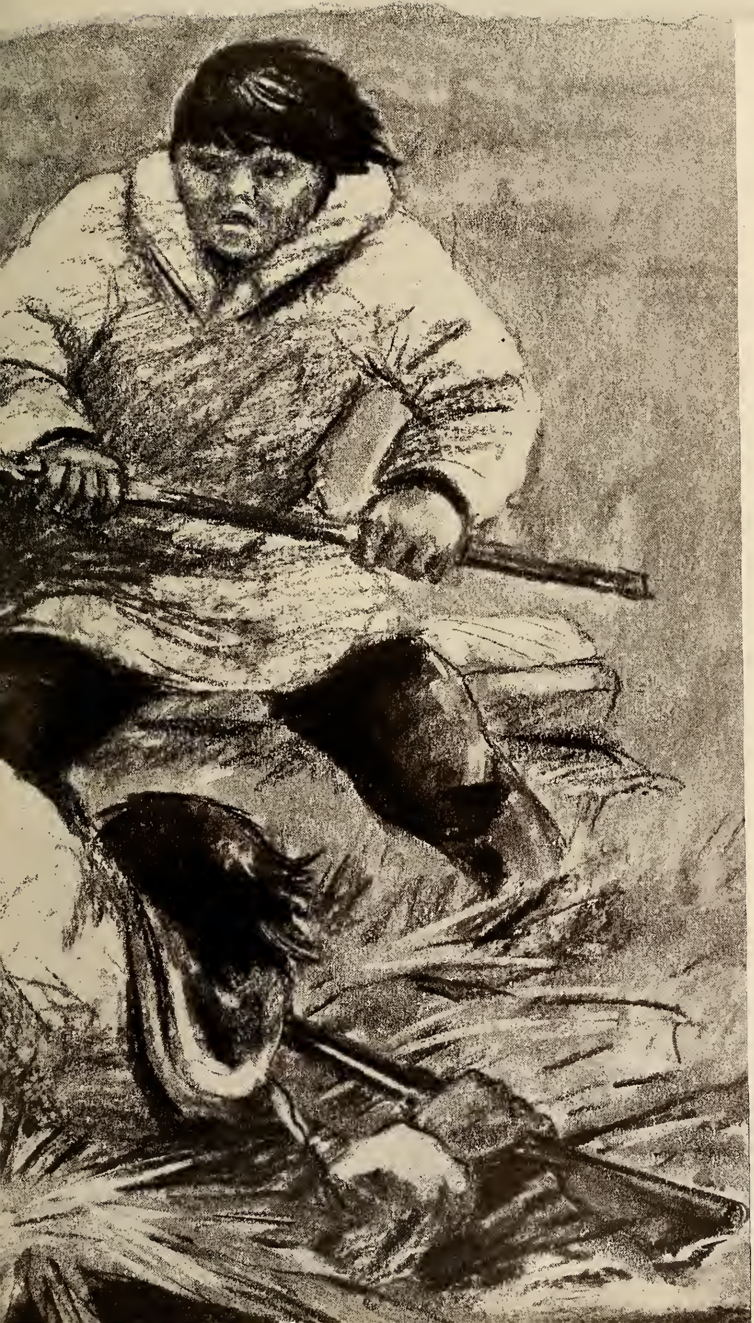
INOPINATUS—
The Unexpected

The only specimen of this bear ever secured was speared by Eskimos more than 80 years ago. Does the animal possibly still roam the "No Man's Land" of Arctic Canada?

By George G. Goodwin

Associate Curator, Department of Mammals, American Museum of Natural History

HERE—on the Arctic tundra along the polar shores of Franklin Bay—you may meet a rugged, sunbleached inhabitant of Canada's Western Northland, the Barren Ground Grizzly. "The characteristic disposition of this formidable animal may be fairly judged from experience," wrote that famous old naturalist and Arctic explorer, Roderick R. Macfarlane, in his appended notes to *Through the Mackenzie Basin*. He was thinking perhaps of a particular incident that occurred some 82 years ago when two natives of Franklin Bay met and slew a great yellow bear. In his notebook Macfarlane wrote: "About three weeks previous to our arrival at Franklin Bay, in the end of June 1864, two Eskimo hunters observed a brown bear at some distance, and being, for them, well armed, they went forward to meet it and did their best to annoy it by uttering very loud and shrill cries. They made a stop, however, at a driftwood stand, shortly before constructed by them for the purpose of shooting therefrom at passing geese and swans, and there prepared for



◄". . . Just as it was about to spring . . . the other man struck fiercely at it with his spear"

Drawing by G. Frederick Mason

action. One of them carried a Hudson Bay single-barreled flintlock gun, and the other a spear formed by firmly attaching a long knife of Eskimo make to the end of a somewhat slender pole about six feet in length. When the bear had closely approached them, it was shot and severely wounded, which, of course, made it perfectly furious, and it came on so very quickly that there was no time to reload the gun; but just as it was about to spring at and close with the man who had fired the gun at it, the other man struck fiercely at it with his spear, and both soon dispatched it with their knives. This animal will not only hug and if possible crush any unfortunate falling into its clutches but will also bite with its sharp teeth and scratch viciously with its powerful claws, as Indians and Eskimos have occasionally experienced to their cost."

The bear was duly skinned, the hide cured, and the following spring shipped along with its skull to the Smithsonian Institution in Washington, D. C. For Macfarlane, the incident was now closed. Neither he nor the two Eskimos who killed the bear had noticed any significant peculiarities about this particular bear. To them it was just another Barren Ground Grizzly. In the course of time it arrived in Washington and was eventually catalogued, No. 1979 of the Macfarlane collection, skin No. 8706 and skull No. 7149, collected June 24, 1864.

For more than 50 years this yellow bear lay unnoticed in the archives of the United States National Museum. At last, when a sufficient number of big bears had been accumulated to warrant a review of the species, Dr. C. Hart Merriam, dean of American naturalists, came across Macfarlane's specimen. This was no ordinary Barren Ground Grizzly. Nor was its unique yellow coat the basic character that separated it from all other living species. Because of the peculiar formation of the teeth, Dr. Merriam recognized it as a new genus and named it *Velularctos inopinatus*—"unexpected." He discerned resemblances between it and the extinct giant bears Actotherium and Tremarctos.

It was indeed fortunate that this eminent scientist made his discovery and was able to tell the world of this surprising creature just two years before Macfarlane's death.

A search through the published notes and records of early explorers has added little or nothing to our knowledge of this patriarchal bear. However, a significant paragraph in Casper Whitney's book, *On Snow-shoes to the Barren Grounds,* published some 50 years ago, is interesting even if it does not prove that he himself met with this particular bear. Whitney, who had apparently seen a Barren Ground Grizzly at the Smithsonian Institution, wrote, "A bear is found on the Anderson River, which is near the Rocky Mountains, that corresponds to this one and it is possible it may make out into the Barrens in the summer time, but I doubt if it is more than a visitor, and am convinced its real home is much nearer the mountains. It is a peculiar looking bear, seeming a cross between the grizzly and the polar, and it has this peculiarity, that its hind claws are as big as the fore claws, while its head looks somewhat like that of an Eskimo dog, very broad in the forehead, with square, long muzzle, and ears set on quite like the dog's. It is very wide at the shoulders, and its robe in color resembles the grizzly."

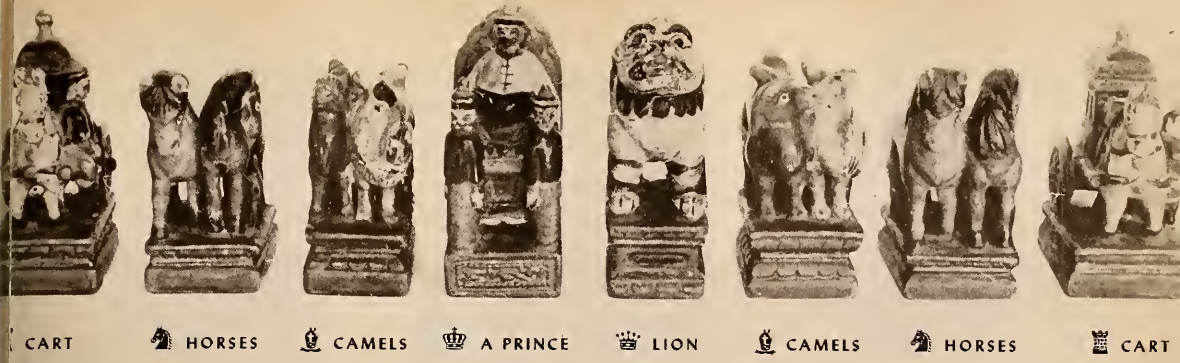
Where shall we turn for further light on this remarkable survivor? R. M. Anderson of the Canadian National Museum believes that it is not extinct, as its habitation is in the remote realm of "No Man's Land," the edge of which is seldom reached by Indian or Eskimo. It is possible that more of its kind may still roam this vast Arctic tundra of Northern Canada. But it is more likely that, as Ernest Thompson Seton said, "this was, like Macfarlane, himself, the last of a rugged, heroic wilderness race, and it survived providentially to fall in his hands and furnish him a monument in the records of the Bears of bygone days."

Although this strange bear has not a great deal in common with the extinct giant bears Actotherium and Tremarctos, the resemblances were sufficient to suggest that Macfarlane's specimen might claim an ancient line of descent quite different from the one that gave us the better-known bears of today.

Anyone who has associated with the friendly Indians of the Northwest has probably, at some time or other, heard them tell the story of a huge bear that in times past made protracted raids in their country. Strangely enough, I find no reference to this legendary story in literature, though Seton, Macfarlane, and other noted explorers, must have been familiar with it.

No matter where you go, in the wilderness of the upper Yukon, on the barren wastes beyond Great Slave Lake, or the rugged mountain passes in British Columbia, the basic facts of this story are always the same. As much as these Indians love to tell exciting stories of wildlife and their hunting experiences, I have always found them dependable and truthful. At first, they were reluctant to tell this story of their fathers, seemingly a little skeptical themselves and doubtful of the white man's readiness to believe it. But eventually, sitting around the camp fire, one gleans the story of a great carnivorous animal resembling a bear, which can kill a moose with one stroke of its huge paws and carry it away as easily as a lynx can carry a rabbit.

If the listeners seem not too skeptical, the Indians will continue to tell how, after one of these bears had raided the country, you can follow its trail by the blood spattered on the upper branches of the trees, until eventually it is lost beyond the timber line. Where the beasts came from or went, none of the Indians seem to know. The story no doubt has some truth and could have originally been brought by visiting Indians from the West where the huge Kodiak bear, the largest living carnivorous animal in the world, towers above the stunted trees of the Pacific Coast. It is also within the realm of possibility that some such giant bear actually existed here, as Inopinatus did, before the coming of the white man.



▲ A ROYAL CHESS SET from Outer Mongolia, formerly owned by the Living Buddha of Shandagu. These chessmen, carved from light wood and brightly lacquered, are from the Red, or "good," side

CHESS *with Mongolian Lamas*

The asking of a simple question at a lama temple discloses some fascinating facts about the evolution of chess and brings to light certain aspects of Mongolian philosophy

By SCHUYLER CAMMANN*

All photographs by Carl Schuster except where credited otherwise

"DON'T you Mongols have any games?" I asked the host-monk at the lama temple we were visiting. I had to come to northwestern Inner Mongolia two months before on a special mission, and, being interested in ethnology, had been spending much of my spare time studying the customs of the Mongols in their tents and temples, but as yet I had never seen them playing games.

"We have *shatara*. That is 'horse chess,'" he explained in Chinese, the only language we had in common.

"Is that anything like the Chinese 'elephant chess'?" I continued.

"No," he replied. "The Chinese have nothing like it."

I felt somewhat relieved. Chinese chess is a rather dull game played with inscribed counters on a maplike board. Its complicated rules make it entirely different from the chess played elsewhere.

My host tried to change the subject—it seemed to embarrass him—, but I persisted and asked if I could see a set.

He turned and mumbled something in Mongolian to one of the young lamas who was clearing away the remains of our evening feast, and the latter hurried out of the guest room. While we waited, he explained quite frankly that the Chinese merchants and settlers in Mongolia always laughed at the Mongols for having such a foreign and barbaric game, so they only played it among themselves, and did not usually let visitors see it. However, since I was a guest and had come from so far, he felt obliged to humor my request.

In a few minutes the young lama returned with a red lacquered box and a large wooden board. He placed them between us on the raised dais at the back of the room, where we sat cross-legged in Mongol fashion on a felt rug. Then, since it was already getting dark; he brought over a couple of butter lamps from the row standing before the shrine-box in the corner.

The board was about three feet square, painted white, with a raised edge of red. In the center, narrow black lines marked off the 64 squares. They were not checkered

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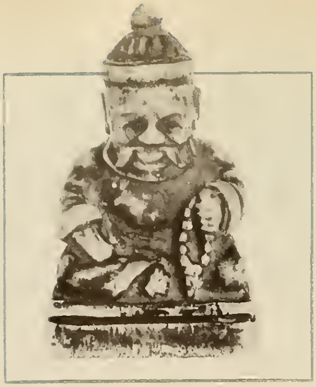
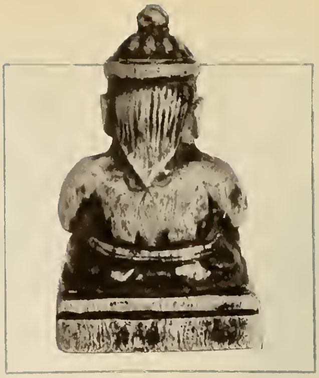
* After graduating from Yale in 1935, Mr. Cammann went to China on a two-year teaching contract with Yale-in-China. In vacations, and during a third year of travel, he visited all but one of the eighteen provinces of China proper, and Northern Indo-China, and made a brief trip to Inner Mongolia. Nearly a year after the outbreak of the Sino-Japanese War, he left China by the Burma Road (which was still under construction), and spent several months in Burma, India, and West Tibet before returning to this country for graduate work in Oriental studies. He entered the U. S. Navy before Pearl Harbor, and was eventually sent back to Asia.

While serving in West China in 1945, he was sent up to Inner Mongolia on a special mission, where he devoted his spare time to studying the life of the Mongols.—ED.





THIS FOREIGN KHAN (*front and rear views*) is the "king" on the Green, or "evil," side. This piece represents a Turkish, or Central Asiatic, khan. His hair is cut relatively short behind, whereas Mongol princes and Chinese viceroys always wear pigtails. His beard is also broader and heavier than that of a Mongol

as in our chess, but were left white.

My host slid off the top of the red box and removed a folded square of coarse native paper, ruled in lines like the wooden board.

"This is what we use to play on when we go traveling," he explained. "The large board would not fit well in a camel pack." Then he shook out the gaily painted men and began to arrange them at the ends of the board.

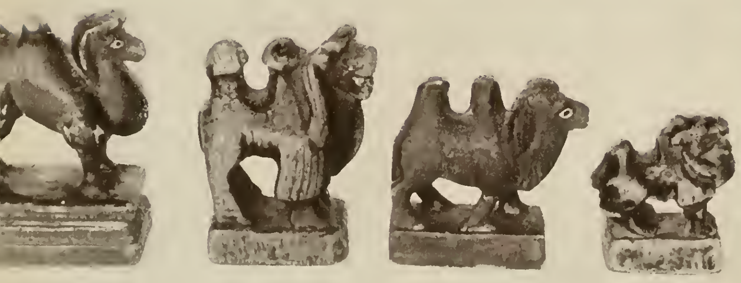
Willow Chessman

I was surprised and pleased at their appearance. They were carved from willow wood, then painted and varnished. The two sides were distinguished by the colors of the bases, one side red, the other green, but there were also differences in the form of the pieces.

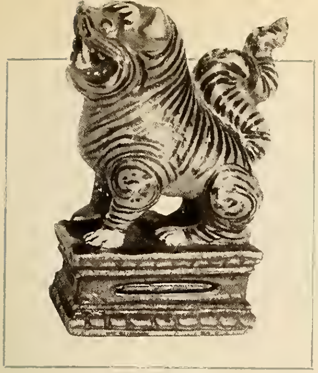
The red "king" was a Mongol prince, and the green one a Chinese viceroy, both wearing colored robes and hats with peacock feathers, and seated on cushioned thrones. Instead of "queens," the Mongol "king" had the sacred white lion of Tibetan Buddhist folklore beside him, while the Chinese counterpart had an evil tiger.

It was not until after I left Mongolia that I found the explanation for this radical change, which differentiates Mongol chess from all other varieties. The Indians, who invented chess about the sixth century, had made the principal figures a king and his minister, or vizier. From India the game spread west to the Persians and Arabs, and finally to the Europeans, who changed the vizier into a queen, as a more suitable expression of European civilization. Sometime later the game spread east to Central Asia, where the Mongols found it at the time of their great conquests in the thirteenth century. Now the Persian word for "vizier" is *firz,* but the Mongols cannot pronounce an F, and changed it to *birs.* They already had a word *birs* in their language, meaning big cats in general—lions, tigers, leopards, etc., —and in time they apparently forgot the new meaning. Thus it happened that when they began to use actual figures to replace the almost shapeless conventionalized chessmen of the Persians (whose religion did not permit picturing men or animals), they carved lions and tigers instead of the kings' ministers. This clearly shows how an imported idea can be changed by the new language and culture.

By another process of evolution, the Mongols substituted camels for the pieces which became our "bishops," and the set that my host had brought out to show me had brown camels on one side and cream-colored ones on the other. Where we would have had simply horses' heads to indicate the knights, this set had the whole animals, fat little Mongol ponies; and in place of our "castles" or "rooks," it had the baggage carts of the two opposing rulers. The latter were very detailed, with miniature grooms holding the heads of the tiny ponies harnessed between the shafts. In short, with horses, camels, and carts, as well as the supernatural animals who assisted them, the two armies were complete. In

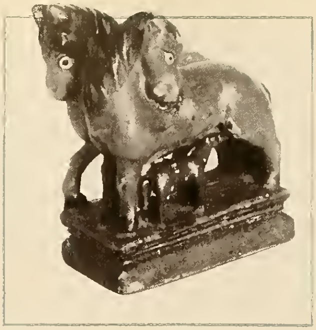


◄CAMELS from various sets. The second is a docile she-camel, the others males. The Mongols use camels in chess where we use bishops



➤ **The evil red tiger** is the Green king's aide in Mongolian horse chess. It was worshipped in the pre-Buddhist religion of Tibet and considered by the lamas as a demon

➤ **A horse family** from the Shandagu chess set, used in place of our horse's head. Originally, in India, this piece was invariably a horse, never a horseman or knight



addition, the red side had a row of small Buddhist peacocks (celestial birds) as "pawns," while the green side had a row of common hens.

I had long since learned of the old Asiatic concept of the great division of all things into two original elements, one representing the good, the strong, the spiritual; and the other, evil, weakness, and material things. Here it came out even in their games.

The Mongols consider red, as they do yellow, a masculine, spiritual color, the color of the Sun; while green is a feminine, terrestrial color, the color of the Earth. The Mongol prince, to the Mongols, would appear as the essence of righteousness, while the Chinese viceroy, as a representative of their hereditary enemies and oppressors, clearly stood for the powers of evil. The Lama-Buddhist lion and the tiger-devil of the primitive pre-Lamaist religion were also the respective upholders of Good and Evil. The camels, horses, and carts of the two rulers did not express any particular antagonism, but it came out again in the pawns, which obviously represented the conflict between the Spiritual and Material, Celestial and Terrestrial.

Invitation to Play

I wondered how it was that this philosophical system had so completely permeated the game, but I did not have much time to think about it. For, when I made the obvious remark that their game looked very much in principle like our European one (as opposed to the entirely different Chinese game), my host immediately invited me to play with him.

His face in the glimmering light of the butter lamps looked shrewd and sly, and I hesitated for a moment, imagining I would find him too sharp an opponent. One of the young lamas, who knew enough Chinese to understand the host-monk's invitation began to snicker. I gathered he was amused at the prospect of seeing a foreigner try to play their national game. This decided me, and I accepted.

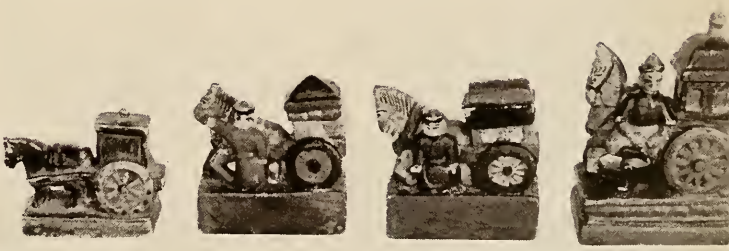
I still was not sure of the moves, so I made a few tentative ones before we began, asking if they were correct. Yes, the khans could only go one square, in any direction; and the lion and tiger (like our "queens") could travel any distance along straight or diagonal lines. The camels used only the diagonals (it was difficult to plot their course on the uncheckered board); the ponies, like our "knights," moved one step forward, and one diagonally; and the carts followed straight lines, like our "rooks."

Good, I thought, everything is the same as in our European chess, I shall not have to worry, once I get used to the unfamiliar shapes. I pushed out a peacock two squares, and after my opponent made a similar move with a hen, started to advance a second peacock the same distance. My host shook his head angrily.

"Not good! Not good!" he exclaimed. "You can't do that; the pawns can only move one square."

"But you let me move my first

➤ **Mongol carts,** used as rooks. Light carts like these are practical for fast traveling and are big enough to carry the folding tents and meager household equipment of the Mongols



bird two steps, and did the same yourself. Why isn't it all right?"

"That's different," he said firmly. "One is allowed the privilege of making two or more moves on your first turn. You made two, so I did also. From now on, you can only move your pawns one square at any time." So the game was played slightly differently after all.

Coaching from sidelines

Another unaccustomed aspect began to get me down. My host had two or three other monks behind him, who increased his natural skill by warning him of my apparent plots and suggesting stratagems to him. Sometimes they would even lean over and make a move for him, or retract a stupid one that he had made. In a surprisingly short time my host said "shāt!" and then "māt!" (sounding much like our "check" and "mate").

My host sat back with a rather smug expression on his face.

"Would you like to play again?" he asked.

I said yes, and we switched sides. By this time I was getting used to the unfamiliar form of the men and I did better, but eventually found myself with my viceroy standing alone against his prince and several other men.

My host sat back as he had before. Once more he asked if I would care to play another time. My face must have shown my bewilderment. He smiled, and explained.

"According to our custom, when a khan stands alone, no one has won the game. We do not take advantage of a lonely man." What a fine gesture, I thought. Frankly it surprised me. After having had several opponents ganging up on me, and having seen my chief opponent retract poor moves after he had made them, I was not prepared for such sportsmanship.

Finally, by the third game, the unfamiliarity had largely worn off, and I managed to beat him.

We played again several times the following day, before and after meals, and when I left, the third morning, the host-lama presented me with the chess box wrapped in a ceremonial silken scarf. It was a gift from the abbot, he explained, in return for the presents I had brought to him when I first came to the temple. I was delighted. There was nothing I would rather have had. Luckily they did not offer me the larger board as that could never have fitted into my saddlebags, but they gave me several paper ones.

From then on, I carried the set whenever I made a trip out from camp to visit the Mongols. However, as I was anxious to see what other types of sets they had, I did not mention owning one until I found out whether this particular community had one. In this way I saw many, including some that were said to have come from Urga, in Outer Mongolia.

Hand-carved sets

I found that the sets were all handmade. Many of them had been fashioned by amateurs working in their spare time, and there were naturally considerable differences in the pieces. Some were most intricately carved, others were rather crude, but none were so badly done as to be unrecognizable, even after they had been battered around in the nomadic life led by traveling lamas.

The khans were always regal-looking, and the red one was always a Mongol prince, while the other was generally a member of the out-group, a Chinese or a Turk. The tigers and lions differed from set to set only in their greater or lesser elaboration. The camels and horses, too, were fairly constant, except in that some carvers represented whole family groups instead of the individual animal, and others stressed the fundamental dualism still more by emphasizing the fact that the animals on the red side were considered males, and those on the green, females. As the Mongols have the same word (*terghe*) to mean both "cart" and "wheel," their "rooks" were sometimes eight-spoked Buddhist wheel symbols instead of carts. These had a double meaning, as the wheel in Tibet and Mongolia is a symbol of royal power, like the orb and scepter of a European sovereign, and was here used as a symbol of the power of the chess prince. Again, I noticed that, by extension, Lamaist jewel symbols were used as "rooks" to signify the riches of the chess princes.

The only chessman that differed more than the "rooks" were the "pawns." Some sets had lion cubs, miniature editions of the Buddhist lion in the back row, pitted against the sons of the tiger. Others had

◄Rabbit pawns (one of the original eight has been lost). These Green pawns were opposed to Red falcons, another expression of the fundamental conflict between the weak and the strong in oriental philosophy

falcons versus hares, and birds of prey opposed to harmless waterfowl. Whatever the combination, however, the "pawns" always maintained that fundamental antagonism in the world of the chessboard which was thought to mirror the dual forces in the greater world of men.

The constancy of this fundamental idea baffled me. I was still wondering about it when, on the way back to China proper, I went to visit a large monastery (Wojer-in Sume) in the northwest part of the Ordos Desert. At the monastery, after the usual formalities of present-giving, exchanging snuff bottles, and tea-drinking, I mentioned chess, and the young host-monk, the disciple of the Living Buddha, who was absent on pilgrimage, beamed at me.

A forbidden pastime

At first I could not understand his expression of mixed delight and mischief. Then as he set out the pieces of his set, very small and beautifully carved, he told me with pride that it was the only chess set in the region and that he had trouble keeping it, as the Living Buddha disapproved of so frivolous a game.

"If he were to come back here now and find me playing chess with a guest, he would certainly beat me for wasting my time," he said, laughing.

It suddenly occurred to me that this must offer the explanation for the strong religious element, of opposing good and evil forces, in Mongol chess. The higher lamas had probably not approved of the other monks wasting their time over a game, so either they themselves, or one of the offending monks had introduced the moral element to justify the time spent over the chessboard. Was this the whole explanation, or was it that most if not all of the sets that I played with in the temples had been made by monastic craftsmen, whose philosophy had incidentally guided them in their choice of figures? Both factors have no doubt played their parts, but as all traditions of the origin of the game have apparently been lost, we will probably never know.

It amused me to find that the young lama on this occasion played very well. If chess was indeed a forbidden game here, there must have been a lot of clandestine playing; for not only did he show considerable skill, but his inevitable advisers gave him shrewd suggestions that could only have been learned from long experience with the game.

There was no doubt that what he said was true, though. I found that the game had almost entirely died out in the Ordos region. At the lesser temple near Wojer-in Sume, where we spent some days when the expedition truck broke down, two of us were playing one day with my set, when some lamas strolled in for a visit. The younger monks picked up the little horses and camels with grins of amusement at the likelike carvings, but they obviously did not know what they were used for. Finally an old lama came forward, and said:

"Your game looks like *shatara,* our horse chess."

"This is a Mongol set," I replied. He expressed his surprise that foreigners would want to play a lowly Mongol game, and told me that he used to play it years ago, but that there were no longer any sets in the Ordos, nor people who knew how to play.

"How do you move the cats?" he asked, as he seated himself in my friend's place on the dais. I explained. "And the camels?" I explained. The other moves he seemed to know without asking. It was only later that I understood what he had been driving at. I discovered that in the original Persian chess from which the Mongol game was taken, the vizier could only move one step diagonally, and the prototype of the camel could only move two steps diagonally. Apparently in the old man's youth, some people at least still played in the old way, so he asked me first to make sure which system I used.

The Mongols must have learned the more extended moves, developed in Europe, from Russian traders, or from the French and Belgian missionaries who have lived and worked among the people of Inner Mongolia for over a century. It has made for a faster and more interesting game; but I hope that Mongol chess will not evolve still further under foreign influence, to the extent of exchanging its colorful handmade chessmen for the dull, machine-turned European variety. If so, the game will have lost its distinctive Mongolian character and will no longer be an expression of the philosophy of the Mongol people.

Photo by W. E. Hill

➤The author playing chess with a lama. They are using a traveling chess set, in which the board folds in the middle, forming a box to hold the men

Strange Uses FOR ANIMALS

Fishing with spider web nets, reading by firefly light, stitching wounds together with ants—these are but a few of the many ingenious ways in which man makes use of the natural world around him

By Frank W. Lane

NATIVES in many parts of the world have discovered curious ways in which animals could help them in their daily lives, but there can be few stranger uses than that made of spiders by Australasian natives. They get the spiders to make their fishing nets for them. Spider silk is remarkably strong. Experiments have shown that a thread 0.01 centimeters in diameter will support a weight of 80 grams. The silk also has elastic properties and can be stretched nearly a quarter of its original length without breaking. Some of the spiders of Australasia are among the largest in the world. Francis Ratcliffe says that he once blundered into a web which spanned nearly six feet "and almost literally bounced off." The silk of which the web was made was almost as thick as darning wool. How the spiders make the fishing nets is told by A. E. Pratt, who spent two years among the natives in the vicinity of Yule Bay in New Guinea. "In the forest huge spiders' webs, six feet in diameter, abounded. These are woven in a large mesh, varying from one inch square at the outside of the web to about one-eighth inch at the center. The web was most substantial . . . a fact of which the natives were not slow to avail themselves, for they have pressed into the service of man this spider, which is about the size of a small hazelnut, with hairy, dark-brown legs, spreading to about two inches. This diligent creature they have beguiled into weaving their fishing nets. At the place where the webs are thickest they set up long bamboos, bent over into a loop at the end. In a very short time the spider weaves a web on this most convenient frame, and the Papuan has his fishing net ready to his hand."*

The native "goes down to the stream and uses it with great dexterity to catch fish of about one-pound weight, neither the water nor the fish sufficing to break the mesh. The usual practice is to stand on a rock in a backwater where there is an eddy. There they watch for a fish, and then dexterously dip it up and throw it onto the bank."

When Pratt's account was published in 1906, it was regarded with incredulity by many, because the impression is usually given that these fishing nets are made of single threads of spider silk. A single dragline thread is not very strong, so many of them are combined into a crude yarn to form a tough material. Captain C. A. W. Monckton, a resident magistrate in New Guinea, has reported to Dr. E. W. Gudger, of the American Museum, that he has seen fish weighing three, or possibly four, pounds secured in spider web nets. He adds that the nets have also been used for catching butterflies, moths, birds, and bats.

These spider web nets appear to be invisible in the water. As a result, the natives of the Fiji and Solomon Islands have evolved a unique method of fishing, which was described by H. B. Guppy in 1887:

"The following ingenious snare was employed on one occasion by my natives . . . they first bent a pliant switch into an oval hoop about a foot in length, over which

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* Natural History would welcome further information from Australasia on the strength of a web that is "spun in position" as described here and on the extent to which the natives may modify the original work of the spider.—Ed.

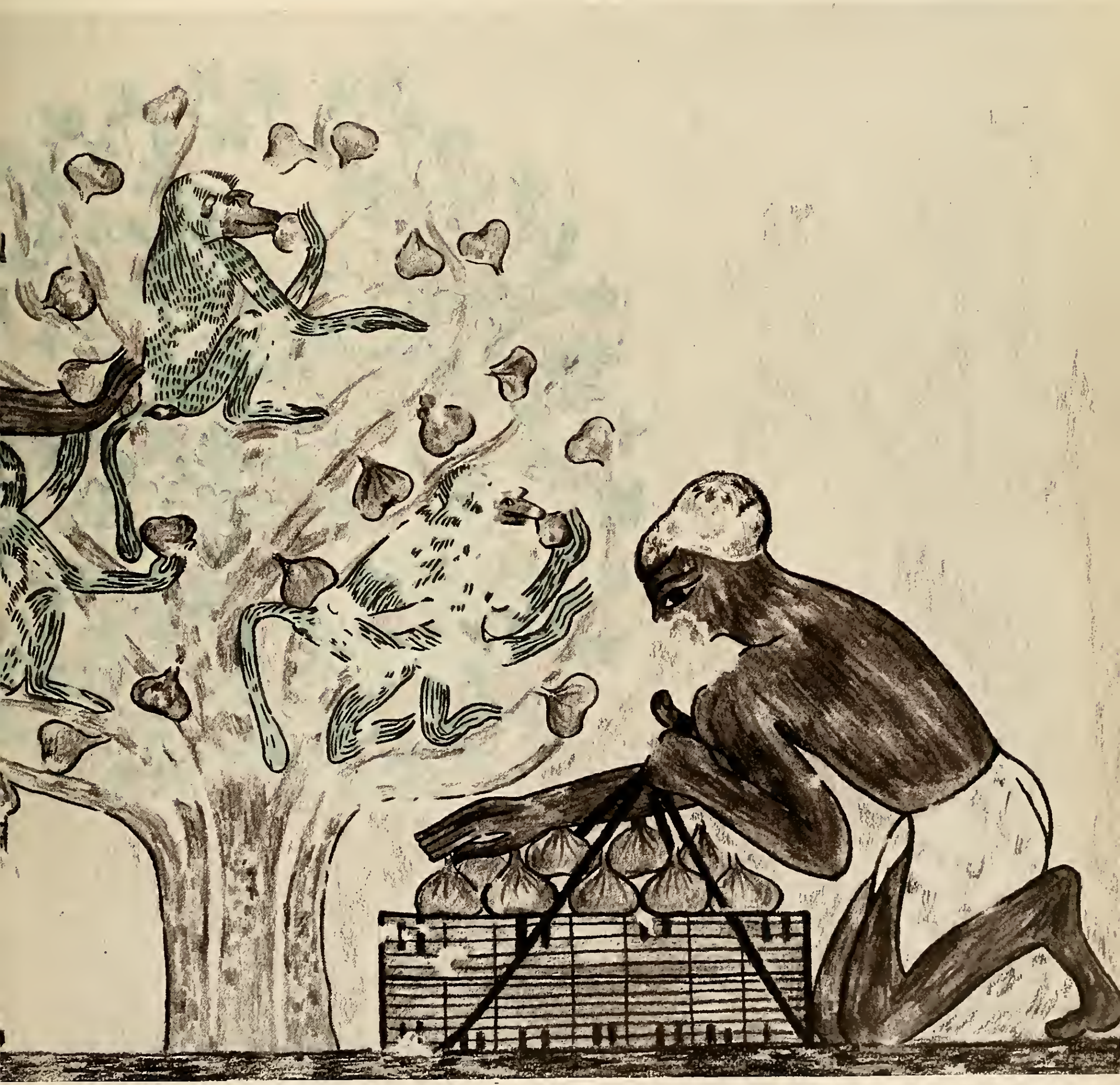
they spread a covering of stout spider-web which was found in a wood hard by. Having placed the hoop on the surface of the water, buoying it up with two light sticks, they shook over it a portion of a nest of ants, which . . . [they had taken from] the trunk of a neighboring tree, thus covering the web with a number of struggling young insects.

"This snare was allowed to float down the stream, when the little fish, which were between two and three inches long, commenced jumping up at the white bodies of the ants from underneath the hoop, apparently not seeing the intervening web on which they lay, as it appeared nearly transparent in the water. In a short time one of the small fish succeeded in getting its mouth and gills entangled in the web, when a native at once waded in, and placing his hand under the entangled fish secured the prize. With two or three of these web hoops we caught nine or ten of these little fish in a quarter of an hour."

Insects that shine in the dark have been put to practical use by West Indian natives, who fasten them to their feet (and, according to some writers, also to their hands) when traveling at night through the forest to light them on their way. A. Hyatt Verrill says that on his expedition to South and Central America and the West Indies he always kept two or three light-giving beetles in a small bottle to serve as a flashlight.

▼ **Monkeys** assisting in gathering fruit: an ancient Egyptian wall design from Beni Hasan

After Nina M. Davis, adapted by Barbara Kurtz



He says the light of one beetle, shining at full strength, enables one to read a newspaper easily. During the Spanish-American War a surgical operation is reported to have been carried out by the light from a bottle of fireflies.*

And, speaking of illumination, the Indians of the North Pacific Coast use the "candlefish" literally as a candle. The entire body of the candlefish is permeated with a peculiar fat which will burn steadily. The Indians thread a wick through the fish's body, and when this is lighted it serves as a candle. Sometimes candlefish are used as torches, the whole fish being set alight and burned until it is consumed.

A very different use for fish has been found by fashionable ladies, who have been known to wear tiny glass fish bowls, complete with small fish, as jewelry. During the reign of Napoleon III, Parisiennes wore goldfish-earrings, in blown glass bowls. In our day, the Hungarian actress, Margot Aknay, is said to have worn exotic fish in flat, water-filled containers of glass dangling from her necklace. The colors of the fish were said to match her gown!

Insects also have frequently been used as jewelry. Malayans capture some of the extremely beautiful butterflies found in their country and tether them to their hair as ornaments. North American Indians sometimes make a necklace by threading on a string numbers of small, brightly-colored beetles. South and Central American Indians use beetle-wing necklaces, armbands, and ear ornaments. Luminescent insects are perhaps the most striking examples of living jewelry. Sometimes they are confined in gauze and tied into the hair. Another method, used by the belles of Costa Rica, is to secure the insects with tiny chains or cords and then fasten them in their hair or on their clothing with a pin. As the insects crawl about and flash their vari-colored lights the effect is very beautiful.

Passing from the decorative to the practical, beetles have been used in primitive surgery, to stitch wounds together. Salvator Furnari, writing in 1845, described how North African native doctors obtained for their purpose specimens of a beetle which he referred to as *Scarites pyracmon.* These insects have mandibles that end in two little pincers. When placed against the edges of a wound, these pincers clamp together and thus knit the wound.

If such a record stood by itself, we might feel skeptical, but there are a number of references to the use of ants in a similar way. Dr. William Beebe, for instance, says that the Guiana Indians use the giant Atta ant to close extensive wounds. The edges of the wound are drawn together, and the ants' jaws are applied to them. When the ants take hold, their bodies are adroitly nipped off, and the jaws, looking like a row of miniature surgical clips, remain until the wound is healed. He says that these ants have a mechanical viselike grip quite independent of life or death. A year after he had been exploring in the homes of these ants, he unpacked some boots he had worn and found the heads and jaws of two Atta ants still firmly attached to the leather. Dr. E. W. Gudger has published other accounts of the use of insects in "stitching" wounds together and points out that this was a regular practice among the physicians of southern France and northern Italy several centuries ago.*

The Balinese, who are great devotees of cock fighting, likewise use ants to clip together bad wounds received by their feathered pugilists. The procedure is described† as being much the same as in the instances given above. This form of ant-surgery is applied to other Balinese animals as well.

Bees have several times been employed in war. When the Duke of Lorraine laid siege to the forces of Henry the First, the commanding general, Immo, threw bees at the attacking horses, which made them

Continued on page 434

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* *Scientific American,* July 1935.

* See "Stitching Wounds with the Mandibles of Ants and Beetles," by E. W. Gudger, in *The Journal of the American Medical Association,* June 13, 1925.

† F. C. Knight, "Cock Fighting in Bali," *Discovery,* February, 1940.

Rainbo

By J

The most famous geologic formation of its kind was not viewed by white men until 1909. It is located in one of the roughest sections of the United States, but it can be visited by the enterprising tourist

HIDDEN away in a remote canyon in southern Utah, sixteen difficult miles from Rainbow Lodge, is this remarkable rock formation which the Paiute Indians called Nonnezoshe—the Big Arch.

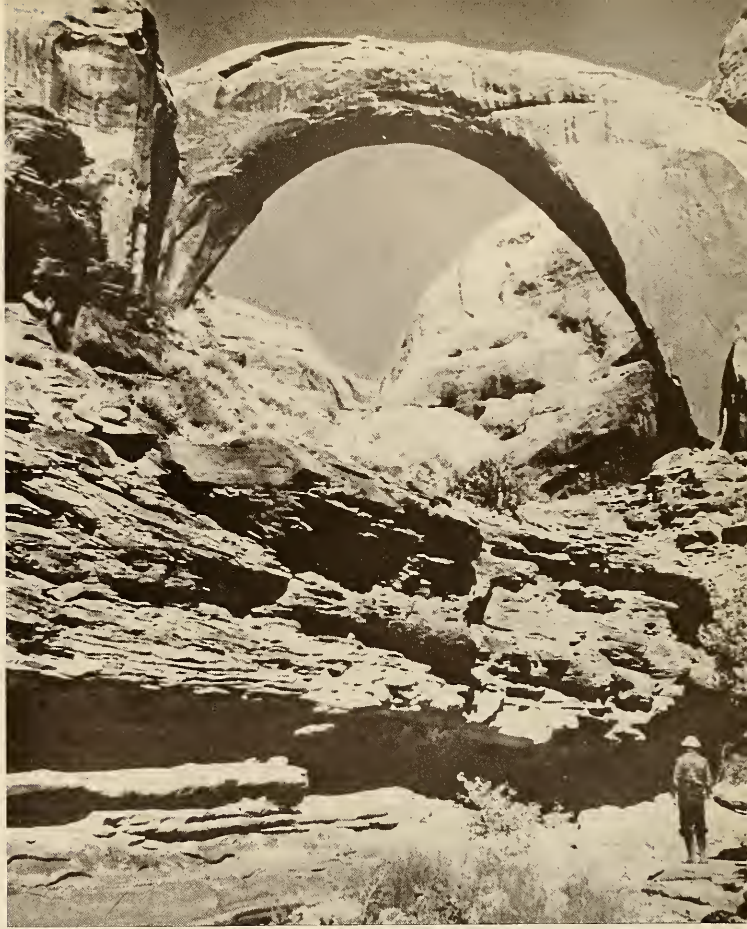
There are many natural bridges in the United States—the Natural Bridge in Virginia, Arch Rock on Mackinac Island, one 8000 feet above sea level in Bryce Canyon, and a number of colorful ones in southern Utah. But for sheer beauty, for size and perfection of form, and for its remarkable setting between huge rock walls, none compares with Rainbow Bridge, truly a symphony in brilliant colored sandstone.

It was not until 1909 that rumors among the Indians of the existence of a rock of unusual proportions attracted attention and led to its discovery by white men. None of the Indians questioned had actually seen it or could tell exactly where it was, until the story was finally traced to a Paiute Indian named Nasja-begay, "Son-of-the-Owl," who had visited the spot. It was he who led the first white men to this natural wonder, in August of 1909. The party included John Wetherill, a pioneer trader in the region, Dr. Byron Cummings of the University of Utah, and W. B. Douglas of the U. S. General Land Office.

It is not surprising that Rainbow Bridge had remained hidden so long, for to reach it the explorers had to cross one of the wildest and most barren stretches of territory to be found anywhere. The terrain is so rough and difficult to cross that even the Indians avoided it. A

Bridge

y Coon



Photograph by John Henry Coon

▲ Rainbow Bridge, in southern Utah, whose graceful arch is so high that the Capitol in Washington could be placed beneath it

confusing series of steep-walled box canyons, some of which still remain unexplored, guarded the spot, and the trails were so steep in many places that the horses often had to be led.

Today the energetic tourist can make the trip, either on foot or with guides and horses. But it is still an arduous one, as shown by the fact that in the 37 years since its discovery only about 4500 of the most adventurous have seen the bridge. You have to cross five of the formidable box canyons. From the top of the last of them you look down 2000 feet to the floor of Cliff Canyon. But when you turn into Bridge Canyon and have your first, though distant, view of Rainbow Bridge, between the deep red sandstone walls of the canyon, the rigors of the journey are forgotten. And coming closer to it, the size, form, color, and beauty of this huge stone arch never fail to excite awe when one sees it for the first time.

Rainbow Bridge rises 309 feet above the bed of the creek and is 278 feet long. At the top, the rock is 42 feet thick and 33 feet wide.

When viewed from a distance, the coloring of the arch blends so well into the background of the canyon that Rainbow Bridge seems to be a bridge in reality, but it is only half bridge, half arch. At its northern end it is a bridge extension from the huge cliff, while at the other end it is an arch, curving gracefully to a flat base, like a rainbow of rock.

The river that carved Rainbow Bridge is today but a small stream flowing into the Colorado River some six or seven miles away, but one would have difficulty finding an area anywhere that would show more emphatically the power of running water to carve the landscape.* At various times in the geologic past, the southern part of Utah has been covered by the sea, and rocks of great thickness were laid down as sediments. At length, the area rose to an elevation of thousands of feet, and streams began to carve their channels. Because their downward cutting greatly exceeded the weathering of the sides, they left the plateau scarred by steep-walled canyons. Rainbow Bridge is now 3750 feet above sea level, and Navajo Mountain, just to the east, is 10,416 feet high.

The walls of many of the canyons in this region show almost unbelievable results of stream erosion. High above the floor, the perpendicular wall of one of them is pierced by an almost perfect circular opening 100 feet or more in diameter. In another canyon wall, hundreds of feet above the bottom, the stream once partially cut an arch and then, finding softer rocks below, gave up the task and left unfinished what might have been the most beautiful arch of them all.

Whether you view Rainbow Bridge from afar or near-by, from any angle or from either side, at any time of day in sunlight or shadow, the spectacle is so striking that you will realize you are in the presence of one of nature's grandest physiographic formations. It is probably the most famous one of its kind in the world. When President Theodore Roosevelt saw it shortly after its discovery, he characterized it as "the greatest natural wonder in the world."

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* The way in which streams make natural bridges and arches has been described in Natural History Magazine for October, 1942.

NATURAL Arches

All these and some seventy others are found in a fifteen-mile stretch of Utah

By Hubert A. Lowman

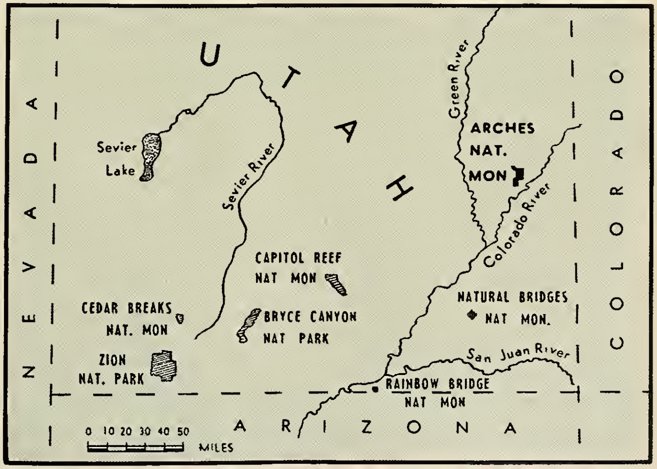
WIND, rain, and the action of frost have sculptured the section of Utah known as the Arches National Monument into as weird an assortment of formations as could be found in so small an area.

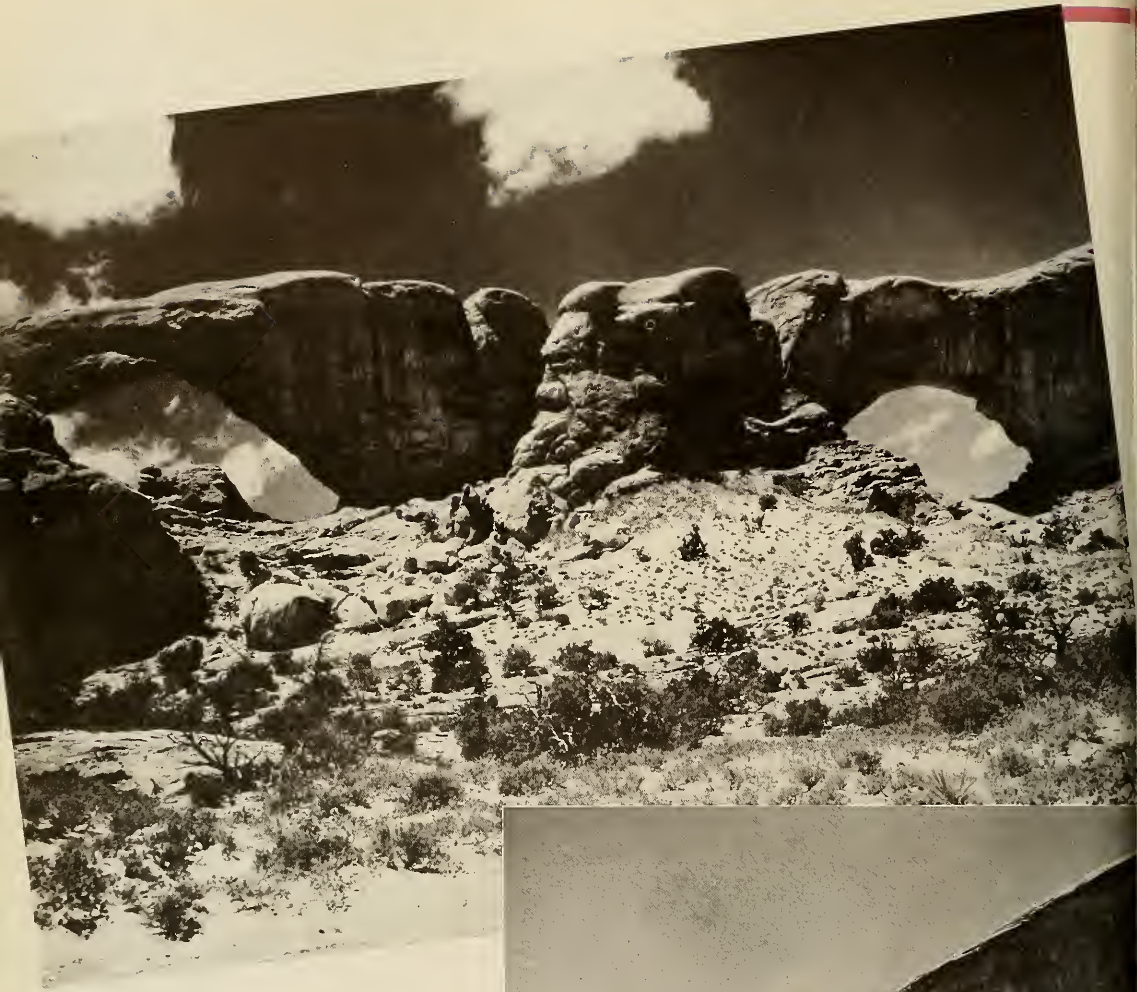
There are five separate groups of formations in the region, the southern Courthouse Towers and Windows sections being separated by the Salt Valley Gorge from the Devil's Garden, Klondike Bluffs, and Delicate Arch sections. The Windows can be reached by road directly from Route 160 a few miles north of Moab. An ungraded desert road down the center of Salt Valley provides uncertain access by motor car to within a few miles of the three northern groups.

Cracks or irregularities in the exposed slabs of red sandstone have given nature's sculpturing agencies a chance to work. Water filters into the crevices and freezes, and the wind works on the rocks like a gigantic sand blast. Gravity tugs at the weaker portions until fragments, sometimes large ones, break off and fall. An opening, once formed, becomes larger and larger; and some of the arches thus formed have become so vast that one almost hesitates to walk under the span, lest it take that moment to complete its evolution. For in time the continuing process of weathering wears the arch thinner and thinner until it collapses of its own weight, leaving only lonely buttresses to recall its former grandeur.

Photography in this area is made somewhat difficult by the fine sand that works its way into the equipment. The photographs shown here were all made on panchromatic film, with a medium red filter on side-lighted subjects where shadow detail seemed important, and a medium yellow filter where lighting was more or less flat.

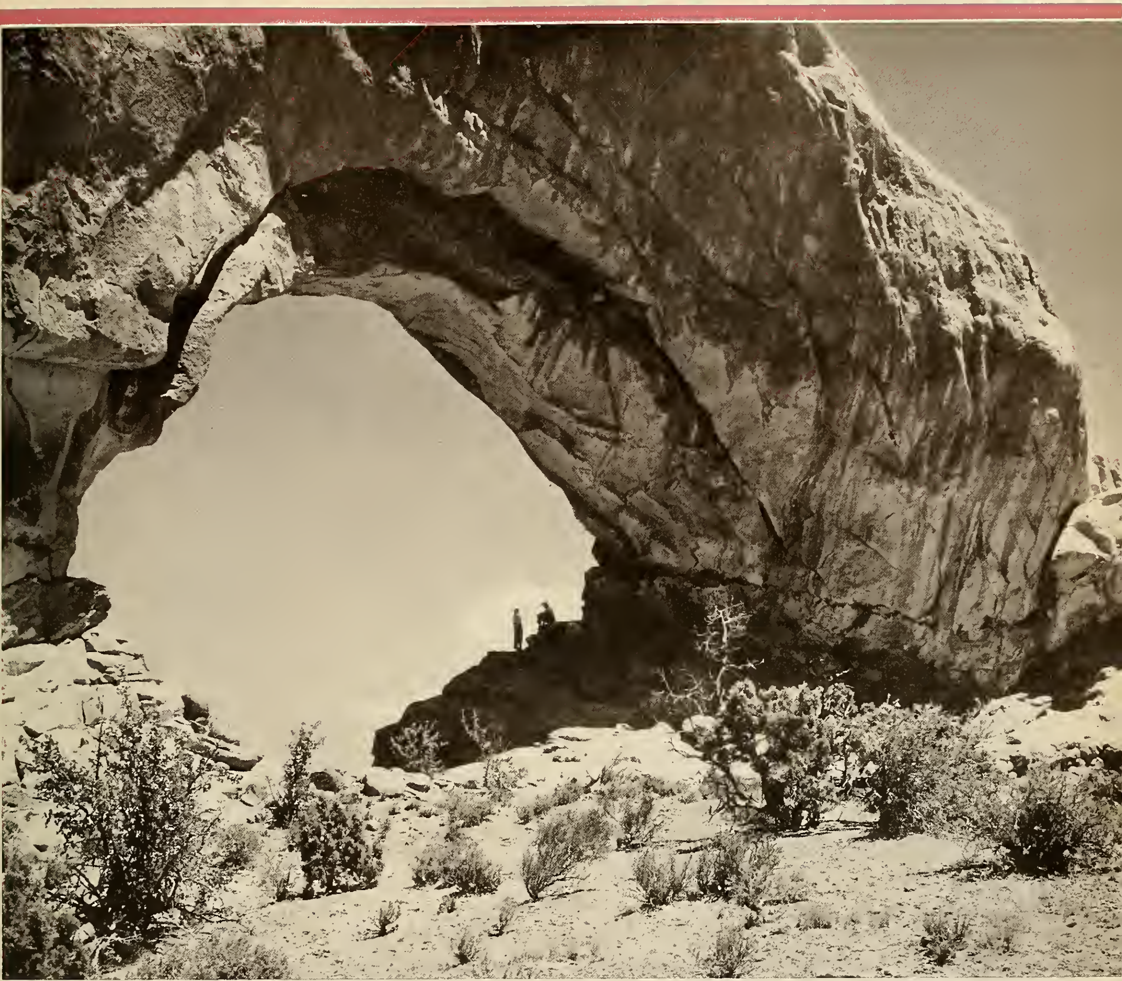
◄Turret Arch does not always receive the visitor's attention, especially if the day is hot and the wind-blown sand annoying, for it is separated from the main mass in the Windows Section of Arches National Monument. Note the infant arch beginning at the left. It may in time join the main arch


U T A H
NEVADA
COLORADO
ARIZONA
Sevier Lake
Sevier River
Green River
ARCHES NAT. MON
Colorado River
CAPITOL REEF NAT MON
CEDAR BREAKS NAT. MON
BRYCE CANYON NAT PARK
ZION NAT. PARK
NATURAL BRIDGES NAT MON.
San Juan River
RAINBOW BRIDGE NAT MON
0 10 20 30 40 50
MILES

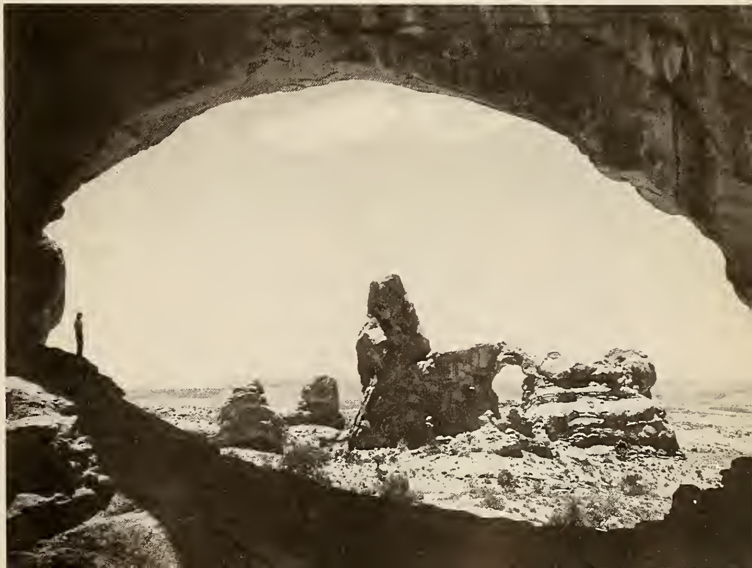


▲ RESEMBLING a gigantic pair of spectacles, the twin arches known as the North and South Windows are each about 100 feet long and 60 feet high. The South Window is on the left

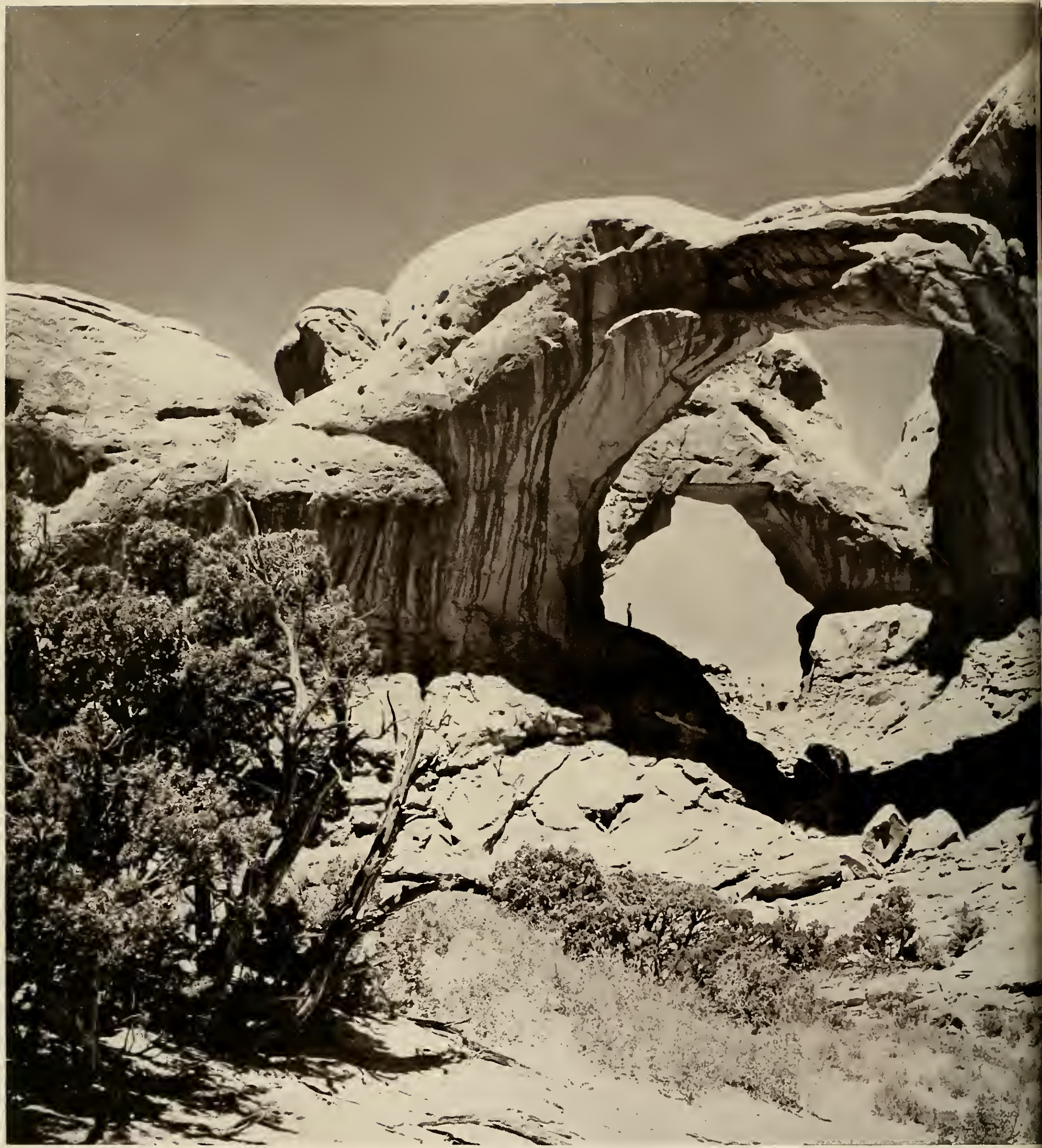
➤ IT IS an exhilarating climb to the opening of the South Window, but the view makes the effort well worthwhile



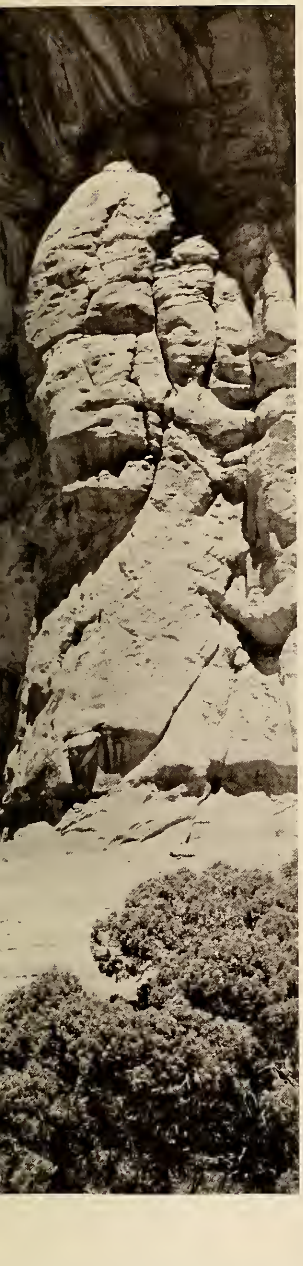
⮝ The North Window illustrates the method by which natural arches are made. Note the huge crack which may enlarge some day to let tons of rock fall to the base of the arch



➤ A favorite spot for photographer and artist is the ledge behind the North Window which affords this view of Turret Arch through the 100-foot opening

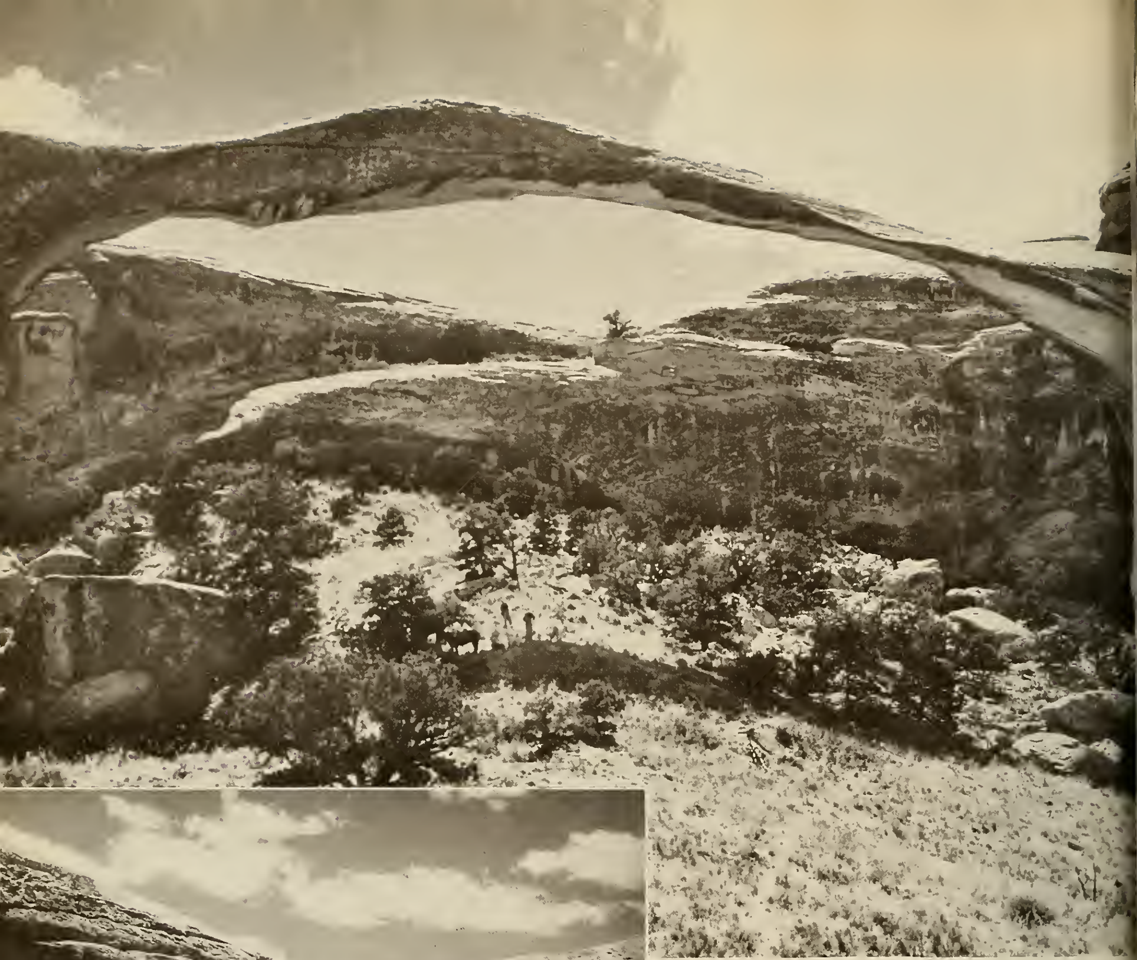


▲ The giant "Double Arch," called the "Jug Handles" by the early Mormons, is also in the Windows Section. The front span is 165 feet long in the clear, and 156 feet high—large enough to hold a 15-story building. Note the human figures which the photographer has conveniently included in this and other views

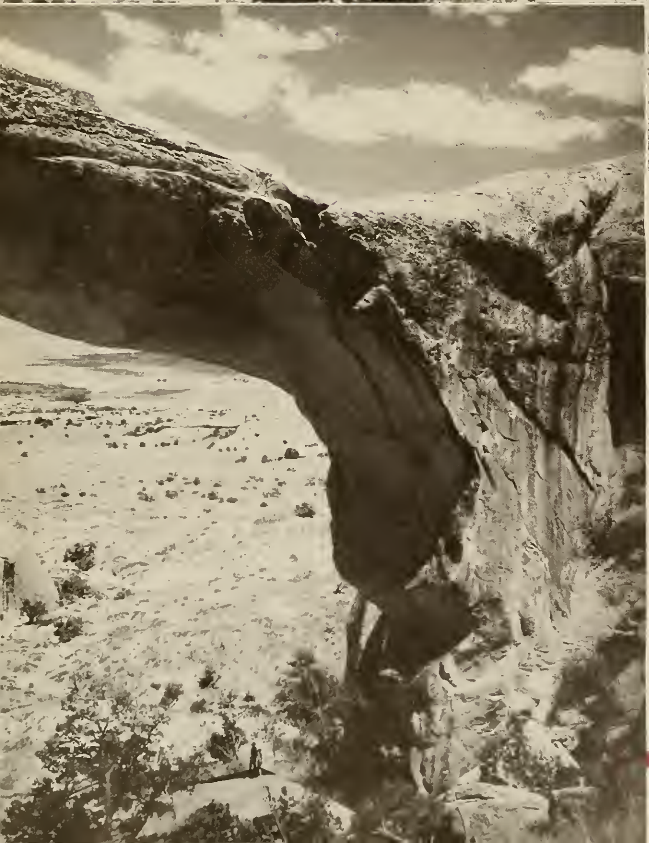


▲ THE BALANCED ROCK: one of many curiously sculptured pieces in the area. This section of Utah also has old Indian camp sites, rock pictures, and petrified wood

➤ DELICATE ARCH rises above Salt Valley Gorge at the edge of a precipitous red cliff. This wild and lonely setting is in the Delicate Arch section of the Arches National Monument



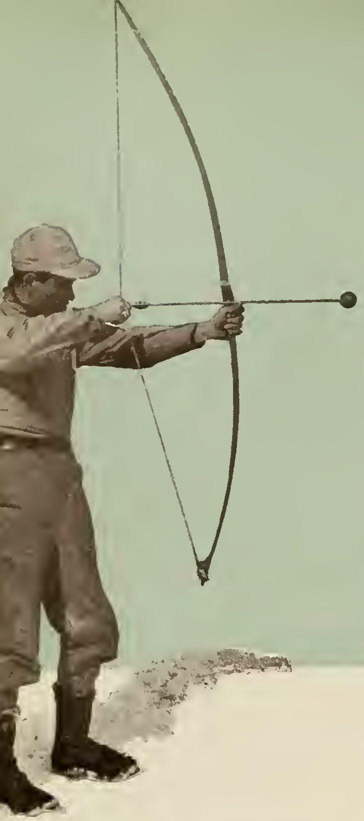
▲ LANDSCAPE ARCH, in the Devil's Garden Section of the Arches National Monument, is said to be the longest in the world. It is 291 feet long (only 9 feet short of a football field) and 118 feet high. It is salmon pink, streaked with black



◀ LOOKING THROUGH LANDSCAPE ARCH from the other side, out upon the broad expanse of plain. Note again the small human figures for comparative size

➤ Beautiful Pine Tree Arch. The horsemen resting in its shade rented their mounts from local ranchers. But farther south in the Devil's Garden the land is so rough that it can be reached only on foot, and it has not been completely explored

▼ This one was called "Arch-in-the-Making" none too soon, for a large piece of rock has fallen out since the area was set aside as a National Monument. (Devil's Garden Section)



WINTER STARVATION THREATENED THE WANDERIN

INGENIOUS WILDLIFE WARDENS FOUND A WAY T

▲ A SPONGE-RUBBER BALL on an arrow provided the solution. Paint of different colors served to distinguish the deer in the various feeding areas

DURING the winter of 1940-'41 the U. S. Forest Service and the Colorado State Game Department began a systematic counting of their deer to determine the number, age, and sex of the animals that wandered from one feeding range to another during the cold western winters.

A great many deer were dying because of lack of food. During the winters their natural feeding grounds were covered with snow, and they had only the six ranges near Gunnison, Colorado, to supply them with food in that area. To mark these deer so that the forestry men could tell which range was their home and how far they had traveled was a puzzling problem. But it was necessary to find this out in order to provide the deer with enough food at the right places. It was solved by the use of paint.

To put paint on a wild deer by any ordinary method, however, is just about as easy as it is to salt a Bald Eagle's tail; so a new method of paint branding was used. A sponge-rubber ball was placed on the tip of a regular target arrow. These arrows were shot by Bun Morgan, one of the rangers, from a 60-pound bow.

Mr. M. R. Hickel, who had served with the Forest Service in different jobs for some 27 years, was in charge of the expedition. The men started out to cover the six feeding ranges located in the mouths of tributaries to the Gunnison River below the town of Gunnison, Colorado. They looked like bandits from the pages of a Wild West book in their grease paint and sunglasses.

Many times these forays required days of travel by snowshoe, ski, and pack train. There are about 4,000 deer in all of the grounds, but only from four to 600 were to be found at one time on any one range. The men were to paint about 300 deer from all the feeding grounds, which meant 50 deer at each station in the state.

The antics of the deer were funny. If a buck was eating when the sponge-rubber arrowhead smacked his side and splattered a four-inch circle on him, he usually acted as though another deer had struck him. The marked animal would lay back his ears and go after the nearest deer, striking him with his front feet.

Paint of a different color was

ER OF COLORADO UNTIL

RAND" THEM FROM A DISTANCE

LIFE SAVING ARROWS

By J. Martin Young, Jr.

Drawing by Museum Illustrators Corps

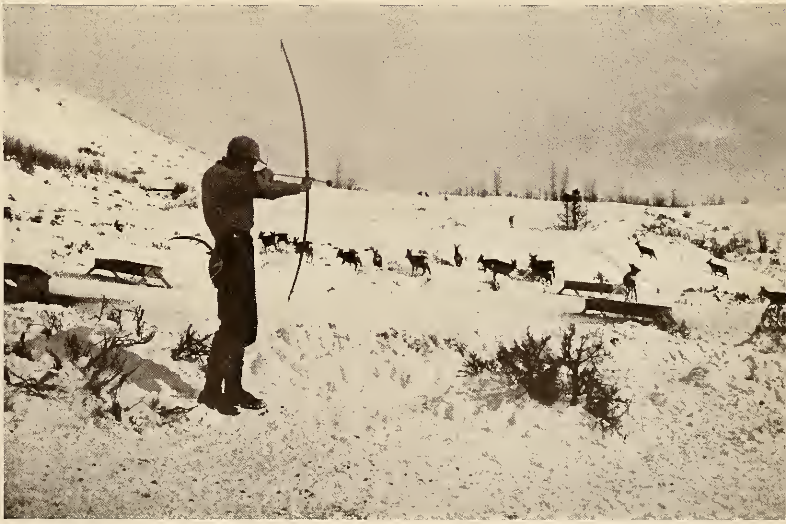
used in each feeding area, so that the amount of migration could be accurately determined. The spot left on the deer was large enough to be seen and distinguished with binoculars at distances up to a quarter mile. The paint spot remained on the animal until it shed its winter coat in the spring. Paint heavier or thicker than usual was used in order to keep it from flying from the rubber ball during the flight of the arrow. The best color, so far as visibility was concerned, was yellow; blue was the poorest. Enamel paints showed up better than oils.

Most of the deer that tended to wander proved to be bucks, but occasionally an old doe would travel quite a distance with her fawns. Older animals moved from one feeding station to another more than younger animals.

This survey enabled the Colorado Game Department to predict about how many deer would feed at each station and to make sure there was an ample supply of food on hand. The death rate due to starvation was further reduced by opening the hunting season on does. At present the Department reports that the deer are healthy and increasing in good proportion of male to female.

◄Enamel paint made a clearer mark than oils

►When the sponge-rubber arrowhead smacked the side of a buck, he would act as though another deer had struck him and would attack the nearest animal



Can the *Whooping Crane* Be Saved?

Ironically, the whooping crane's manner of making love and its wary nature hinder rather than help man in his campaign to save it from extinction

By Lealon Martin, Jr.

THERE are probably fewer than 100 whooping cranes alive in the world today. Once this majestic white bird was numbered among the most plentiful of the migratory fowl. But now it is about to join the ranks of winged creatures that have vanished forever: the great auk, the passenger pigeon, which darkened our great-grandfathers' skies, the Labrador duck, and the heath hen.

Only a concerted effort can save the whooping crane from extinction, and there are those who even believe that this is an impossibility.

As in the case of the trumpeter swan, which was rescued from near-extinction, something is being done to save the crane. The National Audubon Society and the United States Fish and Wildlife Service are jointly sponsoring intensive field investigations of the bird in its whole range. These investigations will emphasize the relation of the bird's welfare to all factors including climate, water-level, plant and animal life, and man. The goal is to find ways and means of restoring the whooping crane as a common bird throughout as much of its former wide range as possible.

Doctor Olin Sewall Pettingill, Jr., of Carleton College at Northfield, Minnesota, has been directing the endeavor, and Canadian game authorities and conservationists are co-operating, since the bird's summer range involves Canada. Part of the work includes the sending out of thousands of copies of a questionnaire and poster containing information and pictures of the whooping crane. In both the United States and Canada, ornithologists, schools, conservation officers, sportsmen, and other interested persons are receiving the request to help save the crane. In Canada, mounted police stations and officials of remote Hudson's Bay Company posts are also being asked to aid. By this effort, it is hoped that valuable, up-to-date information may be furnished by people living in the regions where the cranes pause on their migratory flights, pass overhead, or nest.

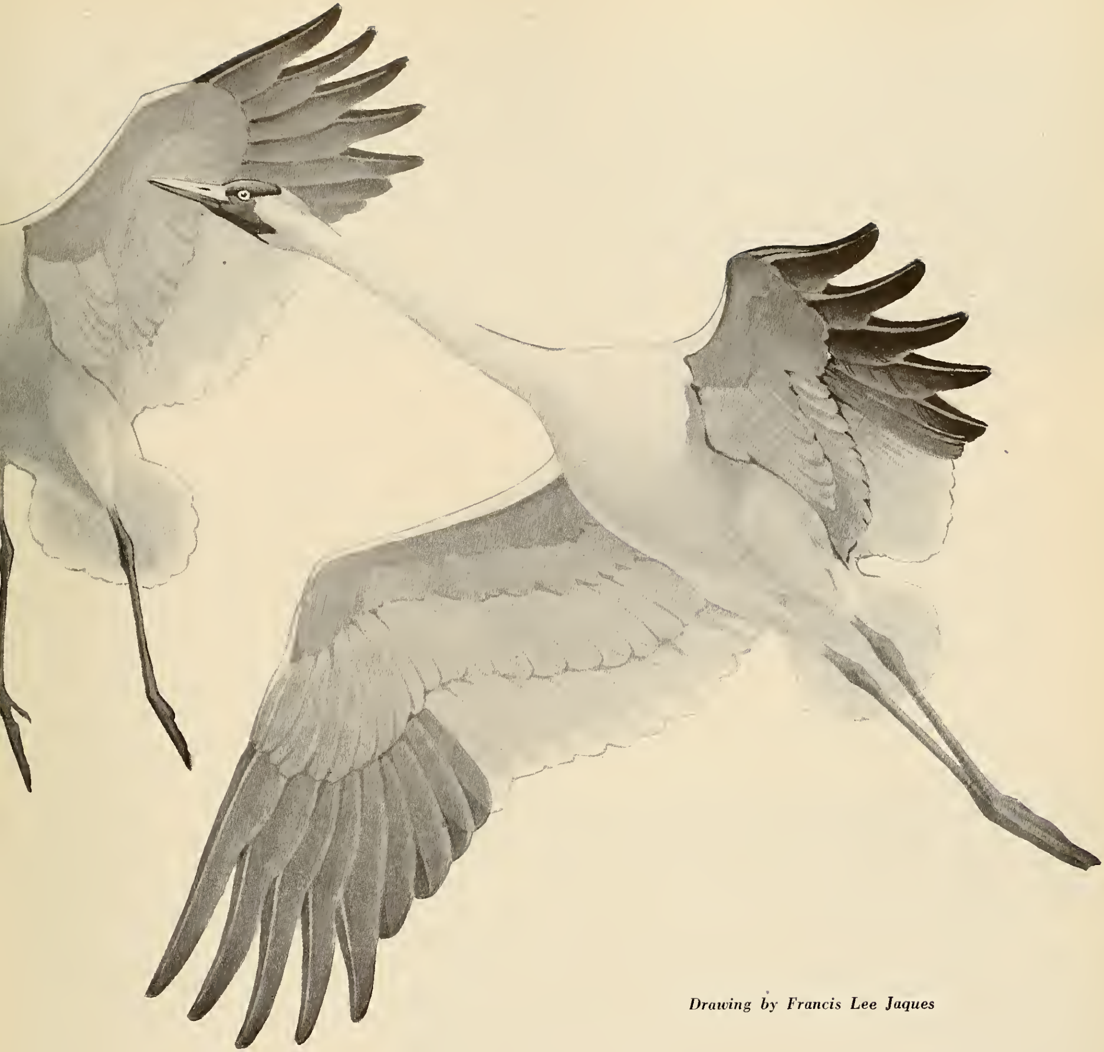
Oddly, though, it may remain for the airplane, a product of the civilization that has nearly destroyed the crane, to have a large share in saving the bird.

"Undoubtedly aerial reconnaissance is our best method of locating whooping cranes," says Doctor Pettingill. "It is my guess that we will find nesting whooping cranes only in regions north of the cultivated areas of the provinces . . . With so few remaining birds, the hunt . . . will be like trying to find needles in haystacks. In fact, our quest for nesting whooping cranes will be a great gamble!"

But it is a gamble that must be made, or the whooping crane will almost surely disappear from the earth.

Already Doctor Pettingill has employed the airplane in his quest. In the winter of 1945, he flew over the Aransas National Wildlife Refuge near Austwell, Texas. There he counted 25 whooping cranes. Only three of them were immature birds, hatched in 1945. He has also been covering parts of the Midwest, including central Nebraska and certain areas of the Dakotas where whooping cranes may stop over in migration.

If the cranes can be found, it is planned to study their present-day nesting habits and nesting



Drawing by Francis Lee Jaques

range thoroughly for the purpose of determining just what can be done to save them. It is imperative to learn as soon as possible where the crane nests, hatches its eggs, and nurtures its young. Then conservation measures, strengthening those already in force and perhaps involving stricter laws or the establishment of more bird refuge areas, can be decided upon and applied.

None of this is as easy as it may seem to the uninitiated.

The whooping crane's range, for instance, extends from northern Canada to Texas and Louisiana, and possibly but not probably into Mexico. It winters in the south and summers in the north.

The bird's winter range today is believed to be fairly restricted. A flock of 25 cranes was seen near Vermilion Bay in Louisiana fifteen years ago, but in recent years only two have been seen. It seems to pass the winter mainly in a rather limited area near the Texas coast. Although the whooping crane is known to have wintered in northeastern Mexico almost a century ago, it has not been recorded there for many years. Reports from central Mexico that the bird winters there are thought to be erroneous.

Once upon a time the whooping crane nested in the middle western United States (and to some extent in Canada), but half a century has passed since the last authentic records of its breeding were obtained in our Midwest. These came from Iowa, in the year 1894. And no

▲ **Whooping cranes** on typical feeding grounds. Most of the few remaining birds apparently pass the winter near the Texas coast

▲ **Here** in the Aransas Refug
Dr. Olin Sewall Pettingill,

authoritative record of its breeding in Canada has been made since 1922. In that year an observation of the bird was made in Saskatchewan. It probably nests now, ornithologists think, only in northern Alberta and Saskatchewan, and perhaps in Northwest Territories and northern Manitoba.

This means that vast spaces of these prairie provinces must be examined. Although the airplane will prove a boon, it by no means solves all the difficulties. The region is hard to explore thoroughly. There is a lot of land, and there are a very few birds.

Beyond this, the whooping crane is perhaps the wariest bird in the world. And well may it be! From colonial days, when the crane first met civilized man, down to the present, its tall white body has been an irresistibly attractive target for the gun. The crane has learned that man means death. Justifiably, it is hard to approach.

"Should we find nesting whooping cranes," declares Doctor Pettingill, "our problem will have only begun. They are the wariest of our North American birds. When a person approaches to within a quarter of a mile, they seem almost panic-stricken and start fleeing." How we are to learn anything about the nesting whooping crane is a problem that will have to be worked out after they are found.

The case of the whooping crane is not, however, completely hopeless. Eminent bird specialists like Frederick C. Lincoln, of the Division of Wildlife Research of the United States Fish and Wildlife Service, believe, as do Doctor Pettingill and others, that positive results can be achieved.

"We were able to save the trumpeter swan from oblivion," Mr. Lincoln recalls, "and it may be possible to preserve the whooping crane. Not many years ago there were only a few of the swans left, perhaps no more than 50 or 60. Now their number has been increased to over 300 in the Red Rock Ledge Refuge in southwestern Montana."

Mr. Lincoln emphasizes, though,

The female lays two (sometimes three) eggs each year on a nest built in some quiet, desolate, marshy area. She is easily disturbed while nesting. This is a view in a habitat group at the American Museum

A.M.N.H. photo

25 whooping cranes from
lane in 1945

James O. Stevenson photos. Courtesy Fish and Wildlife Service, U. S. Dept. of Interior

▲ THE WHOOPING CRANE stands four feet tall and has a seven-foot wing-spread. Its coiled-up wind pipe, if straightened out, would be almost five feet long

that the range of the whooping crane is great, while that of the trumpeter swan is not. "It will be a great deal more difficult, all things considered," he says, "to increase the numbers of the whooping crane. But we hope it can be done."

There are game laws to protect the bird, but a game warden cannot follow every man with a gun who lives or hunts in the isolated marshes and plains where the crane may be seen. The result:

A man with a gun sees this tallest and most magnificent of North American birds. He has never seen anything like it! He trembles; he thrills; he throws gun to shoulder; he fires away! He makes the kill! He does not remotely suspect that he is doing a terrible thing. He does not know that he is murdering one of the few, surviving examples of this noble bird.

Against modern rifles and shotguns, the crane's big, four and one-half foot bulk has little chance. Yet no one would help to kill off the whooping crane if he knew what he was doing. Consequently, those who are trying to protect the crane believe that the education and the co-operation of the public are of paramount importance in the program to rescue the bird.

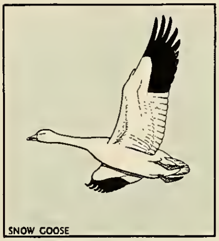
But the bird's nature makes the problem peculiarly difficult. It is intolerant of the advances of civilization. It cannot abide cramped quarters. "So wild and so wary a bird must be much influenced by the settlement of the country," Elliott Coues, the ornithologist, wrote many years ago. As once-uninhabited wilds gave way to the roamings of pioneer hunters, then to the scattered cabins of settlers, and finally to the clusterings of villages, towns, and cities, the great crane withdrew—as long as there remained open to him suitable areas and climates where man was not.

Today the crane must have reached its limit, or nearly so. With its back to an intangible, environmental wall, it has turned around to die, hopelessly. The female lays only a couple of eggs (sometimes three) each year, upon a piled-up

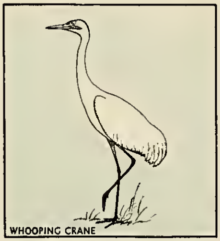
Continued on page 436

HAVE YOU SEEN ANY?

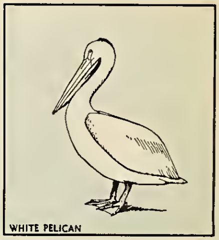
This chart shows you how to recognize the whooping crane. If you see any, please report your information to ROBERT P. ALLEN, c/o The National Audubon Society, 1006 Fifth Avenue, New York 28, N. Y. Tell WHEN, WHERE, AND HOW MANY YOU SAW



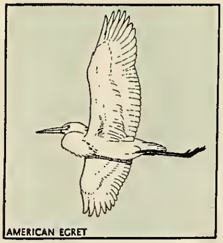
SNOW GOOSE



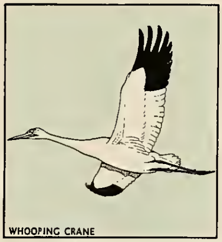
WHOOPING CRANE



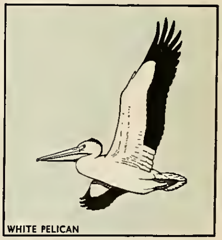
WHITE PELICAN



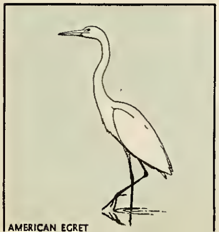
AMERICAN EGRET



WHOOPING CRANE



WHITE PELICAN



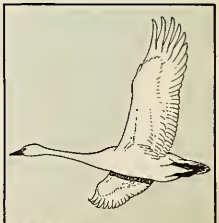
AMERICAN EGRET

Note the pictures of the Whooping Crane and of other white birds with which it may be confused.

THE WHOOPING CRANE:

Stands over 4 feet tall.
Has a wing-spread of 7 feet.
Flies with neck and legs out straight.
Has a white plumage *except* for black tips on wings.
Has black legs and yellow bill.
Has a bare red crown.
Usually nests in big marshes.

Illustrations by W. J. Breckenridge



A Wild Cat Kitten

By Ralph H. Anderson

Photographs from Frederick Lewis

▲ MISCHIEVOUS AS ANY KITTEN, he would play around the tent by the hour

SEVERAL years ago a fisherman stopped at the Big Oak Flat Ranger Station of Yosemite National Park carrying in his hat a tiny wild cat kitten he had found just outside the Park. The hungry little fellow was apparently orphaned and was so young that he seemed to be quite unafraid of his captor.

Rangers at the entrance station undertook to keep the little wild cat alive. They fed him milk with a medicine dropper and gave him a warm place to sleep in the corner of the tent they were using for quarters.

The wild cat thrived and grew rapidly on his new fare. He liked to play with his new friends, the rangers, and chewed up and ate any socks they left around. Often he would sneak through the grass and suddenly leap out to grab the men's trouser legs. On one occasion when one of the rangers used a chamois skin to wash his car, the kitten literally chewed up the skin and swallowed it.

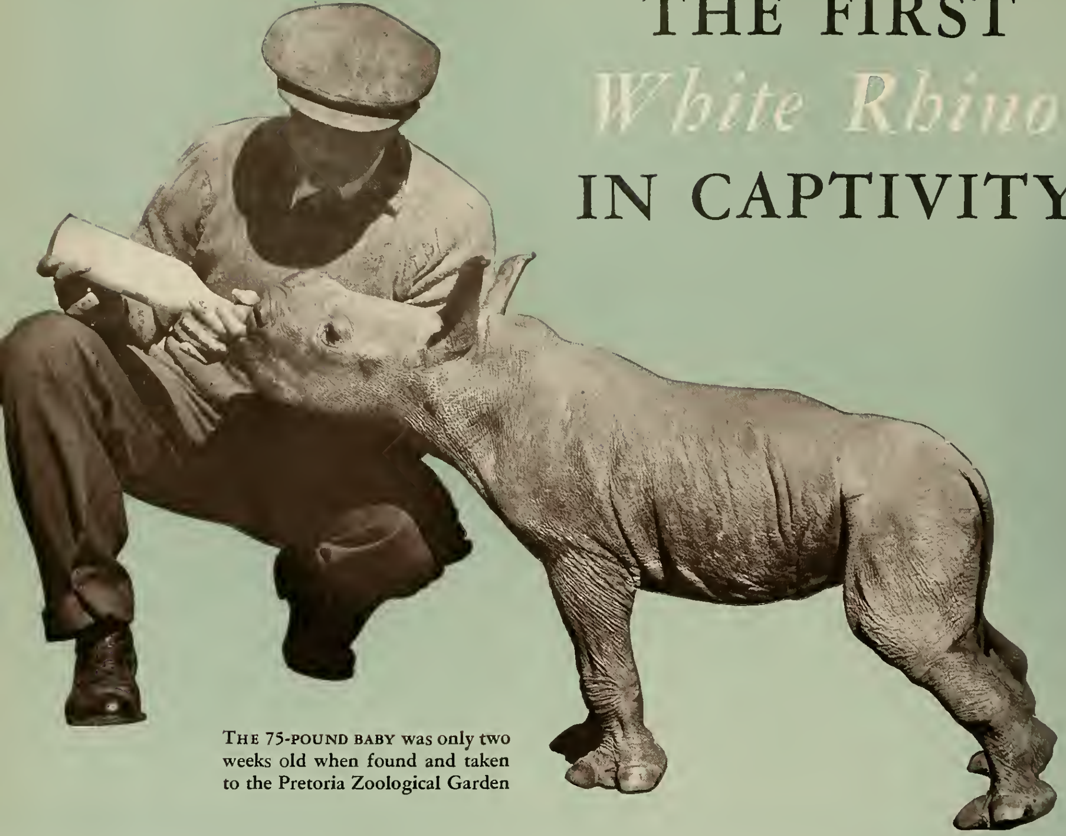
One day a motorist with a dog arrived at the Park entrance. The dog sighted the kitten in the distance and leaped out of the car to chase the little fellow. The rangers smiled when the cat turned quickly, struck the dog a few quick blows with his strong paws, and sent the pooch yelping back to the car.

One of the rangers, Jack Culbreath, was a student at the University of California. When autumn came, he took the little cat with him to Berkeley. There he became the center of attraction as well as an interesting wildlife study problem. But as so often happens when animals are taken out of their natural environment, the cat met an untimely end. One day a bicyclist suddenly rode close to him, apparently causing extreme fright. The wild cat dashed frantically across the campus for a few hundred feet and fell dead.

◀ IN KEEPING with a policy of the National Park Service not to make pets out of wild animals, the little cat was never confined to a cage. He roamed the forest at will and only used the food and shelter the rangers provided if he needed it

➤ CLIMBING AND CHEWING were favorite activities. The kitten chewed up and ate any loose socks left around

THE FIRST *White Rhino* IN CAPTIVITY



THE 75-POUND BABY was only two weeks old when found and taken to the Pretoria Zoological Garden

Martin Gibbs photograph

By ROBERT BROOM

Transvaal Museum

THE so-called White Rhinoceros or, as it had better be called, the Square-lipped Rhinoceros, was discovered by William John Burchell in 1812 in the region to the north of the Orange River in what is now called Bechuanaland.

Large numbers of this huge rhinoceros lived in this section during the middle of the last century. It differed from the Black Rhinoceros in being considerably larger and having a square upper lip instead of a pointed prehensile lip such as is seen in the Black Rhino. Why the early Boers called it the White Rhinoceros might seem difficult to understand, as there is really little difference in color. The true reason appears to be that the White Rhinoceros lived on the plains and was fond of wallowing in any river or muddy swamp, so that its skin was often covered with mud. When the mud dried, the skin appeared from a distance to be a light fawn color.

As civilization advanced, the number of White Rhinos was rapidly reduced, so that by the end of the century fears were expressed concerning its survival. Fortunately it was learned in 1894 that a few had still survived in Zululand. Then in 1899, small herds of a variety of the White Rhino were found in the Lado district of the Upper Nile. These northern herds contained an estimated 150-200 individuals, and it is thought probable that about this number still exist.

In South Africa, the White Rhinoceros ceased to exist in Bechuanaland some time ago, and possibly in Southern Rhodesia. In Zululand it was thought that only about a dozen head were left. Richard Lydekker, in a book published in 1917, did not seem to think there was any hope of the Zululand herd surviving. Fortunately with strict governmental protection the small herd has steadily and rapidly increased, and about 200 White Rhinos are believed to be living now in Zululand.

Just recently it was resolved to make a rearrangement of the reserves, one being reduced in size and the other enlarged. When part of the herd of rhinos was shifted from one reserve to the other, a recently born young one was left behind. It was guarded from the hyenas in the hope that the mother might return, but as she did not come back, Dr. Bigalke of the Pretoria Zoological Gardens was notified. He acted with the greatest promptness and sent a motor lorry with a well-padded crate through the night 400 miles to Zululand.

The little rhino, a female, was rescued and brought safely to Pretoria. She is quite strong on her legs and goes about actively. At present she has only one wish—milk, milk, and more milk. She consumes a gallon a day. Her height is two feet six inches, and her weight 75 pounds. There is practically no hair on her except for a nice little tuft on the tip of her tail. She has, as yet, no teeth. The base of the forward horn is a smooth, rounded, hard boss; there is no trace of the other horn, though two little crescentic hollows on the sides of the brow show where it will grow. Behind her eyes are two little knobs on the cheek bones; and on the top of the neck just behind the back of the head is a curious little patch of thickened skin.

As will be seen in the photograph the head is relatively large and the legs well developed. When standing drinking out of her bottle, she holds much of the weight of the body on the front toes, the lateral toes being off the ground.

Young as the rhino is (and it can't be more than two weeks old), it is full of fight; and if it thinks it is being petted too much, it runs back a step or two and charges with a snort.

The two photographs of adult White Rhinos shown here were taken nearly 20 years ago in the Umfolosi Reserve, Zululand, by Dr. Herbert Lang. They are probably the best pictures ever taken of adults in their native wilds. The square lip is well shown, likewise the peculiar pad on the top of the neck behind the head.

When Dr. Lang took these photographs, he estimated that only about 25 head survived. It is thus gratifying to know that the herd, with careful protection, has now increased to about 200, and there is some hope that we shall be able to re-establish the White Rhino as successfully as the United States has re-established the Bison.

[*A late report indicates that the baby White Rhino is thriving nicely. At two months it weighed 105 pounds.*—Ed.]

Herbert Lang photo

▲ White rhinos are rare today. Two hundred are estimated to be living in Zululand, with perhaps the same number of the upper Nile variety in the Lado District

▼ The white rhino is considerably larger than the Black Rhino, but its whitish skin is the result of mud-wallowing. The two are actually very similar in color

Herbert Lang photo

STRANGE USES FOR ANIMALS

Continued from page 414

so wild that the siege was lifted. Richard Coeur de Lion reduced the citadel of Acre by the same method. He ordered as many beehives as could be gathered together to be hurled among the defending garrisons. To escape the stings of the mishandled and therefore enraged bees, the defending soldiers fled for refuge into their cellars, and before they had emerged, Richard's followers had battered their way into the citadel.

Even in modern times bees have put soldiers to flight. In India once, a cavalryman put his lance through a beehive, and the indignant insects swarmed out to the attack. Their nearest objective was a company of Highlanders, whose bare knees were no match for the bee stings. The soldiers broke and ran. I have read that during the first World War, German troops in East Africa used bees to fight British soldiers, but how this was done I have not been able to ascertain.

The bee has even been used as an accomplice in illegal activities. After the collapse of Italy in World War II, a Swiss trader and beekeeper wanted to smuggle some Italian honey into his country. The difficulty was how to get it across the frontier. He decided to make use of a well-known trait of bees. He managed to get an uncensored message through to his Italian honey merchant, asking him to bring his honey pots out to the edge of a forest near the border and leave them there uncovered. The trader then moved his beehives to a nearby point on the frontier. About 1000 yards separated the bees from the honey. Now, when bees find a rich, ready-made supply of honey, they concentrate all their energy upon exploiting it. That is what happened in this instance. Within three days the Swiss bees smuggled more than 200 pounds of Italian honey across the border under the very eyes of the unsuspecting frontier guards.*

Another animal accomplice in crime is the Indian monitor or lizard. Native burglars sometimes use the larger kinds of these animals as living grapnels. The burglar ties a rope around the monitor's loins and sends it up a wall in which there is a convenient crevice. The monitor enters this and holds strongly enough to support the weight of the burglar, who then scales the wall. This strange use of lizards seems to be confined chiefly, if not entirely, to India. The common Indian monitor (*Varanus monitor*) attains a length of two yards or more, and has amazing strength. One of these animals, or even a smaller lizard, would undoubtedly be equal to the task described. Lizards have been put to similar use in war. An otherwise inaccessible Mohammedan fort was once taken by Mahrattas, who used monitors in this way, according to Sterndale.*

Considering the high intelligence of monkeys, it is not surprising that man has pressed them into his service. One of the most interesting and ancient of these services is in harvesting. The baboon is today considered a rather savage and intractable animal, but paintings on the tombs in the valley of the Nile, dated about 2000 B.C. show baboon-like primates gathering figs and palm fruits for their masters. Sir Gardner Wilkinson, writing in 1879,† refers to this as well as to another strange use for monkeys. In the Jimma country of Abyssinia, he explains, monkeys were still taught several useful accomplishments. Among them was that of officiating as torchbearers at supper parties. Seated in a row on a raised bench, they would hold the lights until the departure of the guests, patiently awaiting their own repast as a reward for their services. Sometimes a refractory one would fail in his duty, and the harmony of the party would be momentarily disturbed, particularly if an unruly monkey happened to throw his lighted torch into the midst of the unsuspecting guests. The offender would be punished by the stick and by privation of food—disciplinary measures that alone were enough to prevail upon them to perform so delicate a duty.

The pig-tailed macaque, a highly intelligent monkey, is employed in Malaya and Sumatra to pick coconuts for the natives. R. W. C. Shelford, who was curator of the Sarawak Museum for several years, saw the monkeys thus employed in Borneo and describes the procedure as follows:

"A cord is fastened around the monkey's waist, and it is led to a coconut palm, which it rapidly climbs; it then lays hold of a nut, and if the owner judges the nut to be ripe for plucking, he shouts to the monkey, which then twists the the nut around till the stalk is broken, and lets it fall to the ground. If the monkey catches hold of an unripe nut, the owner tugs the cord and the monkey tries another." Some monkeys, this author explains, were so well trained that the cord was dispensed with altogether, the animal being guided by the voice of his master.*

Botanists in Malaya have used monkeys for collecting specimens in tall trees. A string some 200 feet long is attached by a swivel to a collar on the monkey. Instructions are given in the native language, and the monkey understands such commands as "Go up the tree," "Pull that twig," "Come down," and several other simple directions. E. J. H. Corner says that one of his monkeys knew the meaning of eighteen words of Malay and, when shown flowers and fruits on the ground, was able to find them in the trees and bring them down.†

These are, of course, only a few of the hundreds of ways in which man has found animals useful. Some of them are a credit to the intelligence of the animal, others to the ingenuity of man; all of them are particularly interesting in this machine age when, beguiled by mechanical contrivances, we are apt to forget that we have not yet learned much about the natural world around us.

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* *The Times* (London), October 18, 1945.

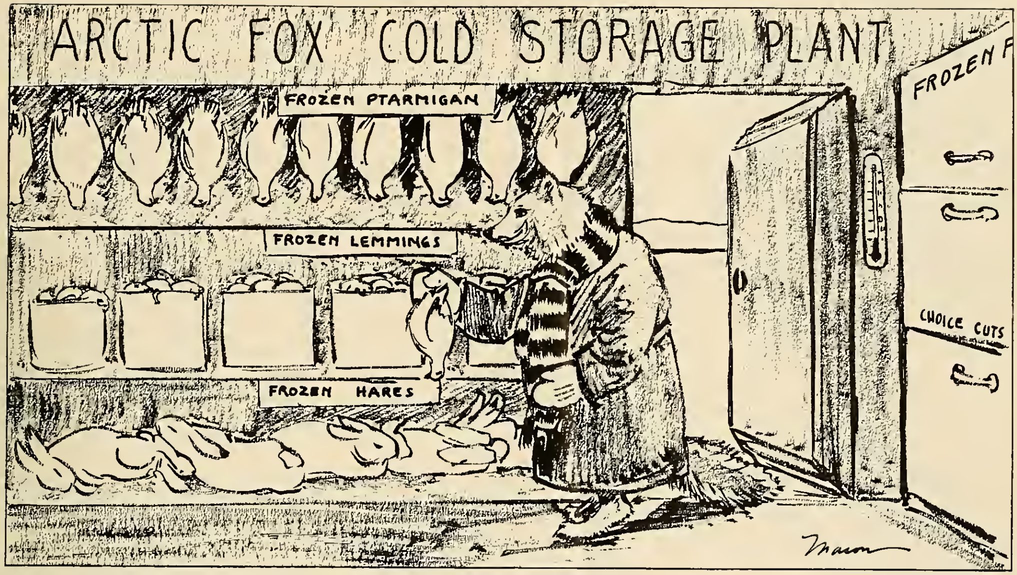
* Gadow, *Cambridge Natural History*, vol. 8 (Amphibia and Reptiles), 1901, and *Mammalia of India* (revised edition by Frank Finn), 1929.

† J. G. Wilkinson, *The Manners and Customs of Ancient Egyptians*, new ed., vol. 1, London, 1878, page 382.

* R. W. C. Shelford, *A Naturalist in Borneo*, London, 1916, page 8.

† In "Wayside Trees of Malaya," *Hongkong Naturalist*, 1941, Vol. 10, Nos. 3 and 4, page 239. See also "The Annual Report of the Director of the Garden, Straits Settlements," Singapore, 1937.

MEAT SUPPLY



By John Eric Hill

Drawing by

G. Frederick Mason

IN recent times we have come to look upon the meat supply in a new light—absence makes the heart grow fonder, as they say. At least in this temperate climate we human beings can get along without meat, little as many of us like the prospect and important though it is in nutrition. The little arctic foxes, however, depend upon meat, and in winter it is often scarce.

During the summer season the smoky-colored foxes find abundant supplies of food in the arctic tundra and along the seashore. Ground-nesting birds are everywhere, in unbelievable numbers. The little canines steal eggs and young birds, and eat the carcasses of those that die from natural causes. Often they seize the parent birds while they are sitting on the nest. Young seals and sea lions that have died or have been killed by storms, and even whales that run aground on beaches, provide feasts for many foxes. Inland, the moss, lichen beds, and the clumps of dwarf willow and birch teem with lemmings, those chunky, short-tailed cousins of our meadow mice.

As with most meat-eaters, when food is plentiful, the foxes gorge. A naturalist once saw one eat nearly the whole of a large salmon and then, hunger still unsatiated, it chewed down a thick leather strap.

But for some eight months of the year the meat situation is not so much rosier for the foxes than are our own prospects now. A few lemmings can be caught in their snow tunnels, and occasionally a fox will catch a ptarmigan or a white hare, and feast upon it. Some foxes, now clad in dense white fur, go out onto the ice and follow polar bears in their hunt for seals. A bear rarely eats all that he kills; often enough remains to keep several foxy hangers-on happy and well-fed. But there are many more arctic foxes than there are polar bears, so this parasitic habit provides for only a small percentage of the fox population.

The habit of storing meat is common to most members of the dog family, from the domestic dog that buries a bone in the back yard to the red fox with his more extensive buried larders. It reaches an extreme in the arctic fox, faced as he is with more severe shortages during winter than most dogs ever have to worry about. An arctic fox in captivity rarely fails to hide or bury an extra piece of meat. Wild ones have been seen to carry off duck eggs and later, months after the nesting ducks have left, to dig down through the snow and uncover a cache containing many eggs. One fox was found to have laid away several hundred lemmings, in hoards of from one to fifty carcasses, as well as the best part of a large hare. A little spoiling of the stored meat only makes it taste all the better to the fox, but in the Arctic many of these food "lockers" are close enough to the external ice to keep pretty well. Reserves of this sort must often mean the difference between life and death for an arctic fox.

Even the arctic fox, however, does not store living provender, which is what the short-tailed shrew does. This little creature gathers snails and stores them alive in its burrows until they are needed. In cool weather the snails remain dormant and cannot escape. It has even been suggested that the shrew may bite them and paralyze them with its poisonous saliva, which if true would explain why the snails seem to remain in the storage chamber even in mild weather.

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CAN THE WHOOPING CRANE BE SAVED?

Continued from page 429

mass of grass and debris about five feet in diameter, a foot or more from water a foot and a half deep in some quiet and desolate marshy area. If something happens to disturb her, away she goes, perhaps never to return to her nest. The whooping crane is not reproducing itself in sufficient quantities to insure its place on the earth.

"It has retreated before our advancing civilization," asserts Arthur C. Bent, an outstanding ornithologist, "farther west and then farther north, for it is one of our wildest birds, it cannot stand human companionship, and it loves the great open spaces in primitive solitude."

So, in the heart of Canada lies the region where the last stand of the whooping crane is being made. Here must be sought the answers to many questions about this strange and fascinating bird.

It stands almost as tall as a man and, on the ground, has often been mistaken for a man or some large animal. Coues once thought that he saw an antelope feeding, with its broad white stern toward him. Cautiously he stalked it—until the "antelope" suddenly took wing and soared away. It was a whooping crane!

The crane has great wings that spread seven feet. The adult's plumage is snowy white, except for the black wing-tips and featherless head, which is a dull red on the crown and the sides of the face. The feet and legs are black. The long bill is dark greenish-yellow.

No wonder that this most stately of all our birds has excited man's interest since colonial days. When the first white men came, the whooping crane was not nearly as wild as it is today. There were many of them then; and when a bird is in a flock or in large numbers it is not apt to be as wild as when alone. Reports of early encounters with the whooping crane say that it could be approached to within a fairly close distance.

The crane would then move away, not in panic but with a stately tread, "taking it easy" as one early writer put it. Its stiltlike legs would carry it across marshy ground without effort at a pace a running man could scarcely equal. Only if forced did it fly, taking off by a curious little running start, as if "going up a stairway of air." As the bird soared higher, it would bring its legs up, finally stretching them out in a line with the body. In flight the long neck would be fully extended, the sharp, rapier-like bill pointing ahead. The wings would not beat swiftly, but with slow, powerful strokes. Sometimes the cranes would fly in bunches or in triangular form, but the favored formation was apparently in single file.

Strangely, this bird delighted in aerial games. Not many men have been privileged to witness the mysterious sky-play that the whooping crane apparently indulged in often in the days when there were many of them. But it must have been an inspiring sight. One of those who did see this air circus reports:

"They proceed to go through many graceful evolutions, flying about in a circle, forming sides, and crossing over and back and dancing in midair to their own loud music." This "loud music" was the characteristic resonant, trumpet-like cry that gives the whooping ing crane its name—"such a cry, redoubled by many echoes, as if an army of men had shouted together," declared an early British explorer who heard a flock of the birds. The sound was one that might have been produced by a great trumpet.

The cry actually is produced by a natural trumpet. The crane has an enormously long windpipe, nearly 60 inches in length, which is partly coiled up and encased in the breastbone and which, if stretched out, would be nearly as long as the bird itself. As the call notes pass through the long neck by way of the windpipe, they are tremendously amplified by resonance. On windless days the powerful cries can be heard for three miles.

But the most enchanting thing

about the great crane is the way in which it conducts its courtship—enchanting and, ironically, tragic. For its manner of making love—a part of nature's plan to perpetuate this creature—has been, because of man, a contributing factor to the bird's extinction.

The whooping crane stays chiefly in low places, according to our best information. But in years gone by, when the birds were numerous, mating time brought them together on high knolls, in the early mornings and again about sundown, in spring and summer. There they would congregate in a courtship dance. There would be much bowing, capering, and the courteous or coquettish flapping of graceful wings. Prancing and scraping about, the elegantly plumed ladies and gentlemen of crane society would happily mingle together. They would trumpet in joy. But while they were thus happy, forgetting their usual caution and making love, the whooping cranes were, alas, visible a couple of miles away. Man, with his gun, came close. He easily made the kill. And so the crane's innocent, charming dance helped it on toward oblivion.

All this is mostly past history, and most of our knowledge of the crane is based upon early scattered observations. Published scientific knowledge is extremely scanty. Yet there are many stories about the crane, even stories (mostly legend) of how the bird has turned savagely upon man and fought back. Ernest Thompson Seton has written of how a young Indian shot down a whooping crane. The Indian stooped to pick up the bird, which was wounded in wing and leg. As he did so, the crane drove its sharp bill with all its force into the Indian's eye. The next day the youth's wife found him lying, dead, across the body of his victim.

To add to the knowledge of the crane is one of the primary purposes of the investigation now being conducted. Dr. Pettingill has suggested several ways in which everyone in regions through which the whooping cranes pass or in which they may dwell can add to this knowledge and help save the crane. They are:

1. Report at once any observations you may have made on whooping cranes at any time. Especially desired are exact dates, localities, numbers seen, and activities noted.

2. Encourage everyone who lives in a region thought to be inhabited by whooping cranes to watch for and report on the birds.

"The smallest item of information," says Doctor Pettingill, "may provide an important clue, so send it along."

Urgent other duties have very recently obliged Doctor Pettingill to pass on the responsibility of directing the whooping crane survey to an able successor, Robert P. Allen. All information should be sent to him, c/o The National Audubon Society, 1006 Fifth Avenue, New York 28, N. Y.

Can the whooping crane be saved?

Yes, we are told on good authority, if the remaining stock remains vigorous and keeps a well-balanced sex-ratio, the whooping crane may be restored. There is yet hope for this tallest and most fascinating of North American birds.

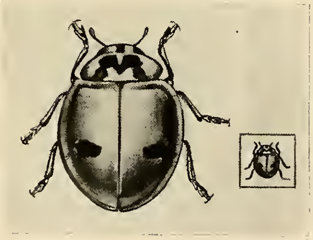
Insects in the House

LADY BEETLES

By C. H. Curran

Associate Curator, Department of Insects and Spiders, American Museum of Natural History

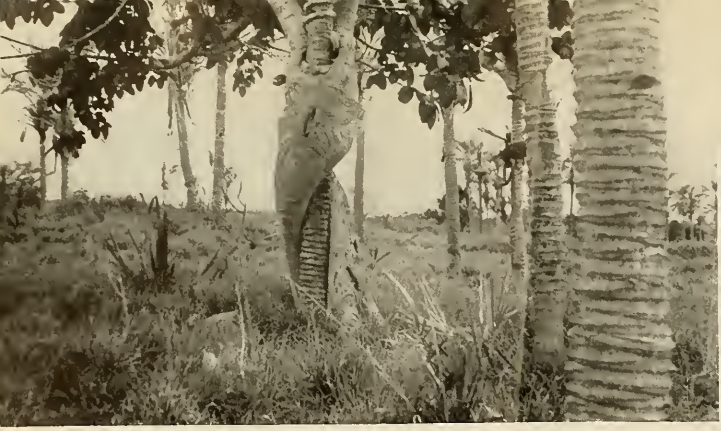
Many of the insects that enter our homes are not pests; some of them are our friends and are so recognized by householders. Among these are various kinds of Lady Beetles, or Ladybugs. Both the larvae and adults feed on plant lice and other small insects, and a single larva may eat from 20 to 50 aphids a day. The adults are much less voracious but nevertheless play a very important part in keeping aphids under control.



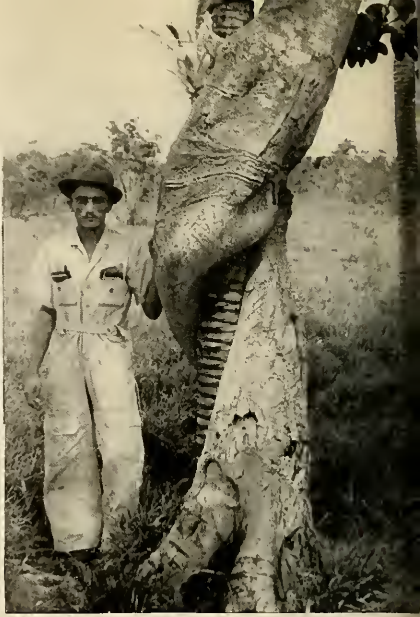
Inset shows actual size

When cold weather sets in, the adult lady beetles seek a sheltered place in which to pass the winter, and many of them find such a place in a house. This is not ideal for them, because the warmth induces activity, and it is doubtful that many of them survive the winter.

Most persons who ask for information about lady beetles in the home during the cold months of the year are anxious to protect the beetles, but there is little that can be done. If a warm conservatory is available they may do all right provided there are aphids on the plants, but they show very little inclination to feed on aphids on window plants. Up to the present we are not aware of any method by which the householder can protect the beetles so that they will survive until spring, but it seems possible that they might survive if placed in a really cold cellar. Otherwise it would seem advisable to release them out-of-doors on a warm day, thus permitting them to search for a satisfactory place in which to hibernate.



▲ AN OURICURI PALM GROVE in Brazil. The strangler fig (encircling the palm in the center of the picture) has taken root in the soil and could probably stand erect without the support of the palm



▲ A CLOSE-UP of the lower trunk of the same palm, showing how it has been completely encircled by the strangler fig

Strangler FIGS

By ROBERT W. SCHERY

Photographs by the author

Missouri Botanical Garden,
St. Louis, Mo.

ONE of the most curious plants of the tropics, attracting the immediate attention of travelers, is the picturesquely named Strangler Fig. This name, although not to be taken too literally, is not entirely a misnomer. Strangler figs often do twine their stems and roots about other plants and, if circumstances permit, contribute to the death of the host plant by completely encircling and overburdening it.

The strangler fig begins life as a minute, sticky seed borne inside the ball-like fruit of the mother plant, a fruit from a receptacle so specialized that only certain insects are normally able to fertilize some of the many small flowers within it. This small seed, meeting no adverse fate, may be carried some distance, perhaps on the beak or foot of a bird. When it comes to rest on the trunk of a tree or in some crevice of a cliff, or falls among mankind's ephemeral ruins or other earthly debris, it germinates, and there its destiny unfolds.

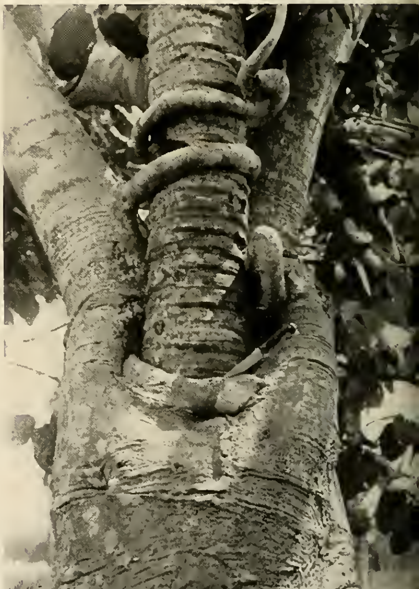
The young, newly germinated seedling is able to live the life of an epiphyte—a plant whose roots do not need to reach soil but can derive all the necessary elements for life from the tropical atmosphere. Nor does the young seedling need to derive nourishment from the tissues of the host plant, as would a parasite.

The seedling produces a blunt root-stem, which gradually works its way around the trunk of its host or snakes its way down the cliff toward accumulated soil below. Eventually many downwardly directed root-stems and upwardly directed leafy branches are in evidence. Stems encircling a tree trunk may grow together to form a living, ever-thickening girdle. Eventually roots reach the soil, and if the supporting tree dies, the strangler fig may remain standing as a malformed but independent tree. The strangler fig is then no longer an epiphyte; it is "standing on its own feet."

Giant strangler figs may completely overgrow the face of a cliff. In southern Brazil I have seen venerable strangler figs whose thin, flat trunks have in this way become about fifteen feet wide. If the cliff is high, few of the roots reach the soil. Instead they penetrate almost every crack or crevice on the rock face. That an ouricuri palm may be overpowered by a strangler fig is plain to be seen in the accompanying photographs.

Aside from their curious strangling tendency, the various kinds of strangler figs appear little different from their multitudinous fig brethren of lesser strangling habits. Sometimes natives use their sap, a gooey fluid, to gum branches of trees where small birds are accustomed to perch. The birds, stuck by their feet, are then easily caught. Wild figs offer sustenance to parrots, toucans, and other animals, but very few have a worth-while fruit from the point of view of man.

Few plants could be called more representative of the tropics than the figs, and, among them all, the curious "stranglers" best convey that feeling of uniqueness and weirdness we commonly associate with the tropics.



▲ A BACK VIEW of the upper trunk of the same tree. The encircling branches have grown together, and a small lateral branchlet has twined itself about the trunk of the palm

YOUR NEW BOOKS

Continued from page 399

woman does not dare go out on the streets, and that nearly all those classes who wore the veil before Reza Shah Pahlavi are wearing it again. The statement also that "elementary education is now compulsory and free" is true in principle, in the sense that universal and free education has been accepted as a goal by the government, but it is very far from realization in towns and villages and scarcely even a hope among the tribes.

However, the reader will find between the covers of *Iran* a truly streamlined and very satisfactory survey of the country and her civilization.

Herrick Black Young.

THE WEATHER

- - - - - by George Kimble and Raymond Bush

Pelican Books, $0.25
185 pp., 20 illust.

THE "Pelican Books" series, the serious works issued by the publishers of the Penguin books, has maintained unusually high standards of accuracy of text and of good popular presentation. The present work, written by expert meteorologists, merits a high place in this good company. The senior author is now Professor and Chairman of the Department of Geography and Director of the Meteorological Service at McGill University, following war service as an expert in the British Naval Meteorological Service.

Although listed as an American revision of an original English work issued in 1943, the book is so thoroughly directed to the American reader as to lead one to believe that it would be difficult to recognize its relationship to its British progenitor. Nearly all illustrative examples cited are from American weather records, phenomena peculiarly American are discussed, and even the photographic illustrations are wholly from American sources.

In addition to the usual descriptions of weather factors, measurements, and phenomena, such as occur in all works on this topic, the present book adds a number of exceedingly interesting discussions of pertinent subjects that are not usually to be found. Paragraphs describe the effect of frost on fruit trees and give advice on the selection of planting sites that will be least subject to severe damage; others discuss the best month for vacations (so far as the weather is concerned) in various parts of the country. The effect of the Gulf Stream on our climate is contrasted with its effect on that of Europe; and the methods used to combat fog around the airports in Britain during the war are described. The range is wide, and the attention is always held.

This book is to be rated as a "must" for everyone who is at all interested in the atmospheric blanket in which we live.

H. E. Vokes.

OCEAN HARVEST

- - - - - - - - - by Carl I. Wick

Superior Publishing Co., Seattle, Wash.,
$3.50, 185 pp., 21 illust.

THIS gives a fairly comprehensive picture of the commercial fisheries of our Pacific Coast, their extent, method, and the life of the men they employ. Boats and gear are described authoritatively and in detail. There are readable chapters depicting life aboard.

Fur seal, whale, sardine, tuna, halibut, shark, and shell-fisheries are included, but well over half the book is devoted to the Pacific salmon fishery. This is appropriately so, considering the extent and interest of this last. The emphasis here is on Alaska. For instance, generalizations apply chiefly to Alaska and not so well to the Columbia River, which is also discussed. Some of the interesting features of the salmon fishery south of Alaskan waters are not mentioned.

The five species of Pacific salmon are differentiated rather well for the general reader; and enough of their natural history is described to make their capture understandable. However, here as elsewhere in the book, the natural history background is sketchy and weak, and not much good for reference. Most of it is obviously secondhand. One notices few statements which might be branded as incorrect, but plenty that might have been worded differently to advantage. At the same time there are items scattered through, presumably drawn from the author's personal observation or his familiarity with fishery statistics, that are likely to interest a naturalist studying marine life of this coast.

J. T. N.

THE BIRDS OF KUTCH

- - - - - - - - - - by Salim Ali

Oxford University Press, $10.00,
175 pp., 51 illust.

THE province of Kutch is in northwestern India on the Arabian Sea. Without high mountains and with a rainfall of only about fourteen inches a year, the vegetation as well as the birds and other animals are predominantly of desert types. Small fertile valleys occurring here and there contain groves of shade

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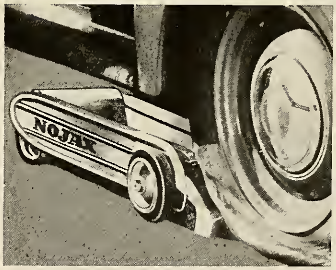

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trees that harbor many of the songbirds characteristic of the more humid portions of India. Scattered "tanks" and coastal lagoons support a great variety of waterbirds. To the north is the barren, salt-covered expanse of the Great Rann. Occasionally portions of this desert are inundated. Then great colonies of flamingos and avocets, the only ones in all India, appear and sometimes succeed in rearing young before the water dries. Kutch lies near the intersection of two great paths of bird migration, one leading into peninsular India and the other across Arabia to Africa.

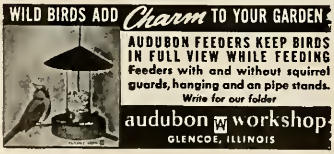
The Maharao of Kutch invited Salim Ali, the leading authority on the life history and ecology of Indian birds, to make a survey of the birds of the province and to write this book. Following a short account of the geography and biology of Kutch, the habits and local distribution of every species of bird known from there are given. Suggestions for field identification are aided by the color plates by Mrs. D. V. Cowen, which portray about one hundred species. These are supplemented by 30 photographs by the author and W. T. Lake. Many original observations on little known species are included, such as the account of the nesting of the white-winged tit and the records of the desert lark on the sunbaked flats of the Great Rann, miles from the nearest blade of grass or source of shade. Salim Ali's book will be indispensable to anyone studying or observing the birds of Kutch and it probably serves as the best handbook available for many of the adjacent more or less arid provinces of India and the Middle East, though the price is rather high.

D. Amadon.

ARIZONA'S NATIONAL MONUMENTS

Southwestern Monuments Association Popular Series, No. 2, Santa Fe, New Mexico, 116 pp. 244 photographs and maps, 8 color illust., $3.00

THIS describes comprehensively for the first time in one volume all of Arizona's sixteen National Monuments. Much of the content is based on material that appeared originally in *Arizona Highways* Magazine. Most of the articles are written by National Park Service naturalists and custodians who know their subects intimately. Thus the book serves admirably as a guide to Arizona's outstanding archaeological, geological, and botanical wonders.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LETTERS

Continued from page 393

We parents who have thinking children who attend Sunday School, know we shall be asked questions along these lines. Your clarity and directness will be of great help to us.

I wish the magazine would think of reprinting just this section, available at a reasonable cost to parents. Far too few have access to this superb magazine. I am taking the liberty of calling it to the attention of both *Parents' Magazine* and *Reader's Digest*.

I believe it is a genuine contribution to our equipment as parents. "Much in little," and oh, so much!

Frances C. Howe.
Winthrop, Mass.

Dear Dr. Simpson:—

It was with considerable interest and much appreciation that I read your answers to the four questions [on evolution] in the September issue . . .

D. P. LeFevre.
Cumberland, Md.

Dear Dr. Simpson:—

Your letter on page 342 in Natural History for September is a splendid one. It has been worded with unusual clearness.

I wonder whether you had thought of publishing this as a little pamphlet, for sale at a penny or two each. It would be quite helpful.

Hanor A. Webb, Ph.D.
Nashville, Tenn.

Natural History Magazine will be happy to send extra copies of Dr. Simpson's statement on Evolution free of charge to any who wish them.—Ed.

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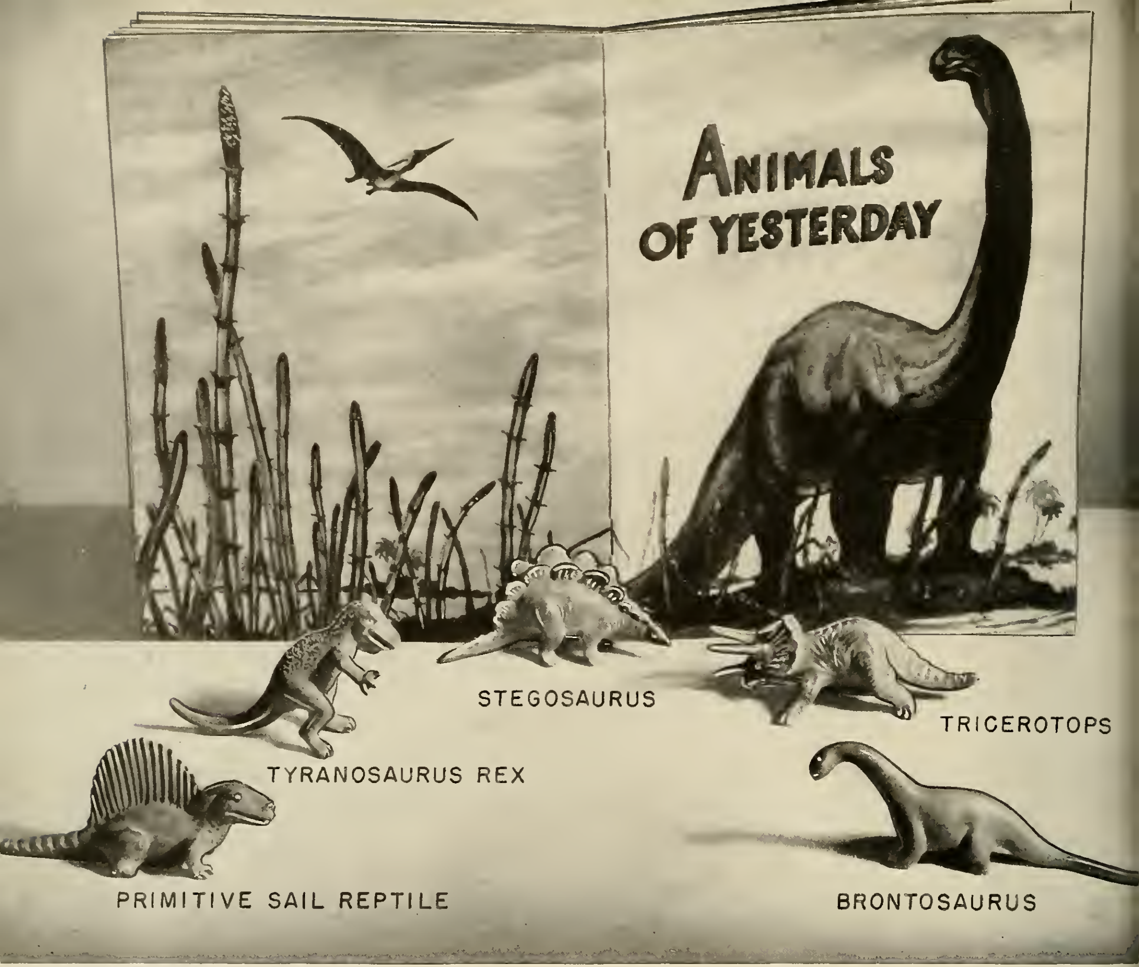
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L E T T E R S

ON PIGS AND PECCARIES

Sirs:

William H. Carr's article on Peccaries, with excellent photographs by Marvin H. Frost, interested me greatly. These animals have had a fascination for me ever since I was a small boy . . . In older books of travel they are always referred to as the American representatives of the pig family, whereas the more recent writings emphasize the differences between peccaries and true pigs. Would it be asking you too much to give us a little more information on this point? I feel sure a lot of people would like to know more about the differences between these animals.

M. M. Young.

Ridgefield, Conn.

The following answer is offered by Dr. George Gaylord Simpson, Chairman and Curator of the Department of Geology and Paleontology at the American Museum of Natural History:

Among native American animals, peccaries are the closest relatives of the true pigs. They evidently were derived from the same remote ancestry as the pigs, and they are piglike in many of their characteristics and habits. Calling them American wild pigs is, therefore, natural enough in popular speech, although it is not technically correct. The ancestral lines of the pigs and the peccaries have been distinct since at least the early Oligocene, probably 35 to 40 million years ago. During this long period they have developed many differences that make it quite easy to distinguish the two groups when they are more closely examined. For instance, in modern peccaries the hind foot has three hoofs and in the pigs it has four (two that carry the weight, and two others above and behind these). The tusks in pigs are large and curve outward and upward, while in peccaries they are directed more downward. The posterior grinding teeth of pigs are much enlarged and very complicated, but in peccaries they are of normal size and considerably simpler.

These and numerous other differences, together with the long separation of the two groups, cause zoologists to classify them in different families, the pigs in the family Suidae and the peccaries in the Tayassuidae. So far as is known, true pigs, Suidae, never occurred in America until introduced as domestic swine by man, but they have long lived in a wild state throughout most of Europe, Asia, and Africa.

Peccaries have lived over much of North America since the early Oligocene. They invaded South America about a million years ago and are now very much at home there. They have never been truly domesticated. A few fossil peccaries are known from Europe and Asia, but they were never common there and are now completely extinct in the Old World, perhaps because they could not successfully compete with their cousins, the pigs, on their own ground.

Besides the domestic pigs and their numerous and varied wild relatives in Eurasia, there are three quite distinct types of living pigs: the African wart hog, the likewise African forest hog, and the East Indian babirussa. There are two kinds of living peccaries, which are closely similar (being, for instance, much more alike than are the wart hog and the babirussa), but they are sufficiently distinct that they do not interbreed. Of course pigs and peccaries cannot interbreed.

* * *

Sirs:

Again I have the pleasure of sending you my check for $10.00 to cover my dues as an Annual Member of the Museum. I am looking forward with pleasure to the lectures and magazine that I enjoy so much.

Elizabeth H. Ward.

New York, N. Y.

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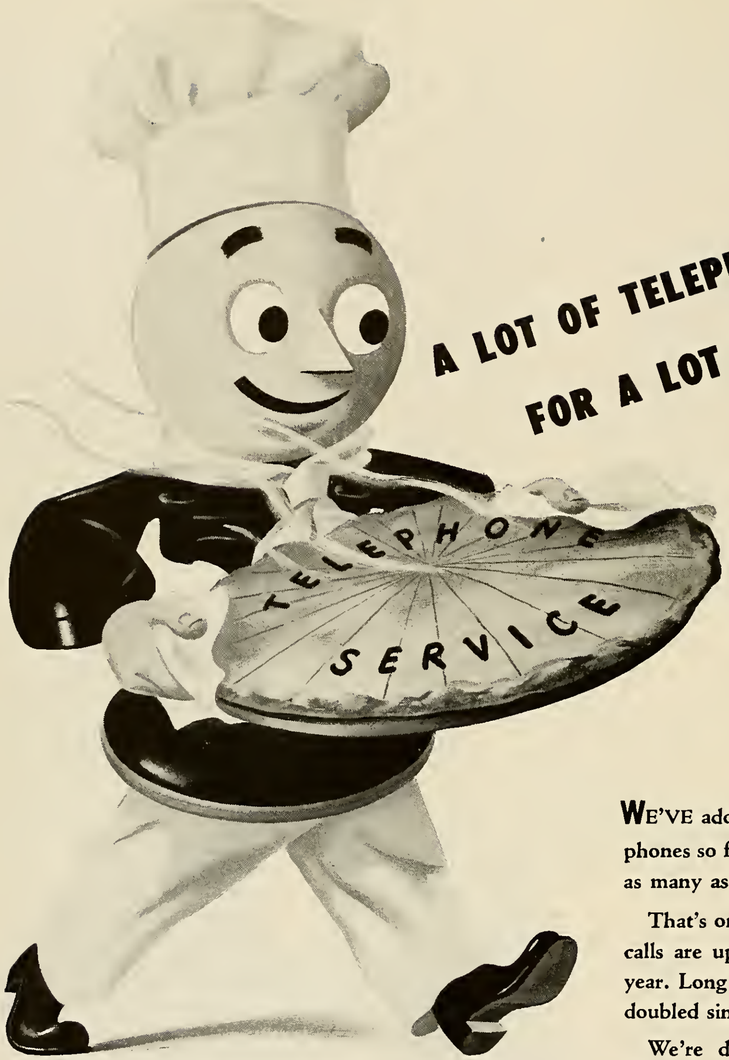

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The Magazine of the American Museum of Natural History

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VOLUME LV—No. 10
DECEMBER, 1946

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The American Museum is open to the public every day in the year without charge

The Yuletide Flower

The familiar blossom that decorates the cover of this issue honors the name of a man who won distinction both in botany and diplomacy

By DOLORES BUTTERFIELD JEFFORDS

YOU see it in florists' windows, and on Christmas cards, and in the decorations of stores at Christmas time; it is printed on rolls of gay wrapping paper, and stamped on ribbons for tying gifts —the brilliant poinsettia that we have come to associate inseparably with the Yuletide season. And the story of its

Nettie L. Smith, from Black Star

name, and of the man for whom that name was given, is as colorful as the flower itself.

It was discovered in Mexico by Joel Roberts Poinsett of South Carolina, first United States Minister to that young republic from 1825 to 1829. A man of many accomplishments and extensive travel, a member of Congress and later Secretary of War, Poinsett was keenly interested in botany as well as diplomacy. In 1828, he sent the plant to Charleston, and afterward to a Mr. Buist of Philadelphia, an enterprising collector of plants. From there it soon went to the Botanic Garden of Edinburgh. Poinsett co-operated with the famous naturalist, Dr. Henry Perrine, in bringing to light this striking but neglected flower, and in 1836 it received the name *Poinsettia pulcherrima* in his honor. Another name for it, though not often used, is "Mexican Flame Leaves," and botanists also know it as *Euphorbia pulcherrima.*

The actual flower of the poinsettia is very small and insignificant, and yellow in color. It is the large, bright red bracts surrounding the flower cluster that give the plant its beauty and distinction. There is, however, a white poinsettia, *alba pulcherrima,* and a pink, double variety, *plenissima,* but these are hardly known, the red ones being the original and by far the most popular variety.

The vast majority of the plants one sees are grown in greenhouses and are small, but in Southern California and parts of Florida and the Gulf States, the poinsettia grows outdoors, to a height of ten feet or more. Despite the fact that it is a winter bloom, it requires a careful simulation of its native climate in order to thrive. The potted house-plant must be protected from drafts of cold air, in a temperature of 70 degrees through the day and not less than 60 degrees at night. In watering it, only tepid water should be used. The soil around it should be kept constantly moist, but not soggy, and water should not be allowed to stand in the saucer under the flowerpot. It was originally a jungle flower, however, and must also be protected from too long exposure to the sun.

The poinsettia belongs to the spurge family, which gives it an odd assortment of relatives. The castor oil plant, which in the tropics grows to be a tree, is also a spurge, as are the many and varied crotons, from which croton oil is made. So is the tung tree from China, the oil from which is widely used for industrial purposes, and the cassava, which is the source of tapioca.

From this family of lowly, utilitarian plants, by some whim of nature, sprang the flaming poinsettia, definitely a decorative glamor girl—to immortalize the name of the brilliant man who introduced it to the world, and to enhance the glowing warmth and cheer of Christmas in the homes of our land.

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PRAIRIE WINGS.

Pen and Camera Flight Studies

- - - - - - by Edgar M. Queeny

Explanatory sketches by Richard E. Bishop

Ducks Unlimited, New York, $15.00
256 pp., 276 photos, 140 sketches

THIS volume is a treasure of bookmaking, fine sentiment, and useful and fascinating information. As a monument to intelligent love of nature, to patience, ingenuity, truth and co-operation, it does credit to everyone concerned with its production.

No strings are attached to its sponsorship by Ducks Unlimited. The author expresses appropriate acknowledgment to this sportsmen's organization, his tribute standing in welcome contrast to recent exaggerated claims by a writer whose book endangered the cause more than it helped it.

Prairie Wings is primarily a display of photographs more revealing than any hitherto made of ducks in flight. Scores of critical pictures are interpreted by means of sketches and descriptive text in which two men have effectively combined their talents.

The photographs include the first wildlife exposures by a "magic-eye" camera, which is a 35 mm. motion picture camera adapted to taking sequences of still pictures. They were obtained with lenses up to 17 inches in length and at speeds up to 1/2000 of a second, although generally at 1/1000 or slightly less. The exquisite reproductions comprise the pick of more than 60,000 negatives. The techniques, including the printing of enlargements of 30 diameters, are elucidated. Explicit statements cover the few photographs that have been tricked up by any artifice and likewise the instances in which other than free wild birds are figured. The palpable honesty and forthrightness of the book are among its many refreshing features.

Good photographs of any wild animals are a pleasure to look at, but the aim of this book is much more than esthetic. By purposeful investigation, by seeking the collaboration of such students of aerodynamics as C. T. Ludington and Glenn L. Martin, and by paralleling—one might say "synchronizing"—the magic-eye shots with crystal clear drawings, the authors have cast more light upon the mechanics and procedure of bird flight than can be gained anywhere else. They show no cocksureness, admitting that interpretation of photographs is limited to well-based inferences. In only a very few cases, however, would it be feasible to depart from their conclusions.

How does a river duck rise vertically from a swimming position? "Jump" is the usual term among naturalists and gunners alike. But Queeny's sequences show that it *flies,* striking the surface of the water with outstretched wings on the first beat, then climbing into the thinner medium with strokes that complete ten or twelve cycles a second. All of this is too rapid for the eye to follow.

Despite the advantages that a bird's wings hold over an airplane, the author shows convincingly that a duck is subject to stalling and to other hazards of mechanical flight. Its powers of rectification and recovery are, however, far superior to those of any machine.

Items for criticism are hard to find in this admirable book. There is an occasional *lapsus* or misprint in the penciled descriptions of Mr. Bishop's sketches, such as the substitution of "ventral" for "dorsal" on page 139. The author underestimates the extent of precise information now available on the physiological basis of migration. Some of his explanations, such as why a moulting duck loses all of its quills together, are superficial. Many organic characteristics evolve not because they are *necessary,* but because they are not incompatible with survival. Certain implications of the author's comments on bird artists (page 225) might be questioned. The function of art is not to express knowlege gained through instruments of precision; a good painting or print need only reproduce an impression obtainable by the normal human eye.

Space does not permit due praise of Mr. Queeny's unobtrusive philosophy, his moving story of a Labrador retriever, written without a trace of sentimentality, and his description of the alluring "Grand Prairie" of Arkansas.

Continued on page 447

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Altogether, *Prairie Wings* is a superb job. It is commended without stint for its enlightening and thrilling attributes. It is worthy of all the recognition it is bound to receive from devotees of nature and of science.

R. C. MURPHY.

BIRDS OF THE PHILIPPINES

- - - - - - by Jean Delacour and Ernst Mayr

Macmillan Company, $3.75
309 pp., 69 illust.

THERE has long been a need for an up-to-date handbook of Philippine birds. McGregor's *Manual,* though still useful, has long been out of date, and Hachisuka's more recent book was never completed.

Owing to the well-known distinctions between the birds of the Palawan group of islands and those of the rest of the Philippine Archipelago, the two areas are here treated separately, with cross references where needed. All of the Philippine species are briefly described, with the exception of some of the wide-ranging sea birds and shore birds. The various local subspecies are noted and their distributions stated, so the account is complete for the region, both for residents and for migratory visitants. Frequent notes on habits are added and keys for the identification of most of the species add greatly to the utility of the work. The line-cut illustrations, by Earle L. Poole and Alexander Seidel, are exceptionally good.

The authors have united many genera whose distinctions appeared to be too slight to warrant their continued separation, and they have reduced many of the species to subspecific rank. Consequently, one who worked with the older McGregorian volumes will find a great change in nomenclature. The result, however, is to bring the Philippine avifauna into more modern perspective in association with groups of wider known distribution.

The reviewer is somewhat less sympathetic toward the changes in many of the vernacular names. English names are provided for all the species (but not the subspecies). Some alterations, undoubtedly, were needed to cover all the members of the newer species-concepts. This is also true in cases where the species to which the Philippine forms are now assigned were already known elsewhere under other names. Where the changes were not required by some such conflict, the reasons for the proposed alterations are not always obvious. Some of the older names are retained while local names are used sparingly. It might have been helpful if more of the local names had been given parenthetically, even though there is some variation from island to island.

The volume has been very carefully prepared and bird students in the Philippines will find it an outstanding aid to the identification of the feathered inhabitants of an unusually interesting region.

JOHN T. ZIMMER.

THE RUFFED GROUSE

- - - - - by Henry Marion Hall

Oxford University Press, $6.50
91 pp., 8 illust.

THE Ruffed Grouse is a tribute by a sportsman to America's finest upland game bird. Of the 20 brief chapters, five pertain to life history, three to conservation, and the rest to grouse hunting (or so we would say, though Mr. Hall, who has a great liking for British expressions, never uses the word "hunting"). The opening chapters give a sympathetic account of the habits and haunts of the Grouse. A discussion of conservation, more factual and less anecdotal than the remainder of the book, with some mention of relevant literature, leads the way to the accounts of grouse hunting under varying conditions and seasons, the latter being the main theme of the book.

The author's enthusiasm sometimes becomes a bit rhapsodical: ". . . these upland partridge have always used the strategic glen. Once within its shades, they become intangible as moonbeams, vague as abstract ideas, unattainable as wraiths." At other times we are brought

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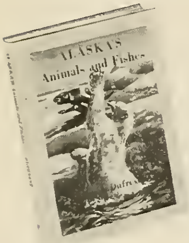

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down to solid earth with a jolt by such sentences as, "I have known a domestic hen to kick stuff over her eggs on being ousted." Although the author's narratives of days afield with gun and dog may fall a bit short of the very top level (as represented, for example, by John C. Phillips' delightful essay "Grouse-shooting with George"), they are usually well done and entertaining.

The large over-all size of the book (8 by 11 inches) increases the effectiveness of the plates. Their reproduction, unfortunately, does not always do justice to the rich colors of the subject. The book is dedicated to the memory of Mr. Hall's nephew, Hugh Birckhead, formerly of the Bird Department of the American Museum, who was killed in action during the war. *The Ruffed Grouse* is a handsome appreciation of a fine bird. It should find a ready welcome in the libraries of sportsmen. DEAN AMADON.

THE COMING OF THE POND FISHES

- - - - - by Ben Hur Lampman

Binfords and Mort, Portland, Ore., $2.50
177 pp., 8 pp. of illust.

OUR East is predominantly lowland; our West is predominantly mountainous. Even though fresh water fishes have been able to cross divides from one river system into another, various types of eastern lowland fishes were unknown in similar waters of the Pacific slope, presumably because the broad mountainous belt of the Rockies was an insurmountable barrier to their distribution. But man has taken them across the mountains, and they are now established there.

The story of how and when they arrived has several interesting aspects. It is a part of the history of a "new country," a subject for pleasant argument among anglers, and important data for students of changes in the balance of aquatic life. The coming of these fishes to the Columbia River basin some 60 years ago is told in detail. In his introduction Stanley Jewett says: "For many years Mr. Lampman has patiently and conscientiously assembled the material for this important and delightful book." It is well that it has been written before the record is further obscured by time. An excellent index enhances its reference value.

The book is comprehensive in scope; carp, bass, catfish, crappie, and even bullfrog receive their due. The abundant historical detail, which it must necessarily include, is flavored with the human interest of biography and character sketch. There are delightful bits scattered through—we would refer the reader especially to the closing chapter, entitled "The Full Creel."

One of the best things about fishing is that it holds an attraction for many diverse tastes and temperaments. Some would seek the giant marlin on the high seas, some would whip with a dry fly along fast streams for trout. But probably a larger number of persons enjoy the contemplative pursuit of less spectacular fishes in quiet waters—a group of anglers whose interest, as the author points out, has been fully expounded by Izaak Walton in *The Compleat Angler.*

J. T. N.

MERRILLEANA

A Selection from the General Writings of Elmer Drew Merrill

Waltham, Mass., The Chronica Botanica Co.; New York City, G. E. Stechert and Co., $4.00, 267 pp., 9 illust. and maps

THIS volume commemorating the seventieth birthday of one of the leading botanists of our day contains a "chapter" that may be of special interest to readers who recall the article "Lost Continents," in NATURAL HISTORY for May of this year. In his "Scuttling Atlantis and Mu," Dr. Merrill here brings together an imposing array of botanical evidence that likewise refutes the arguments of those who adhere to the existence of these hypothetical continents during man's time on earth. This is only one of a host of interesting and scientifically valuable subjects in this compendium, ranging from "Leprosy Bows to Science" to "On the Flora of Borneo." It forms Volume 10, No. 4/5 of Chronica Botanica.

THE NATURAL HISTORY OF NONSENSE

- - - - - - - - by Bergan Evans

Alfred A. Knopf, $3.00, 275 pp.

Or in the night, imagining some fear,
How easy is a bush supposed a bear?
—William Shakespeare.

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It all started with a hitchhiker Dr. Evans picked up. This hitchhiker was

Continued on page 492

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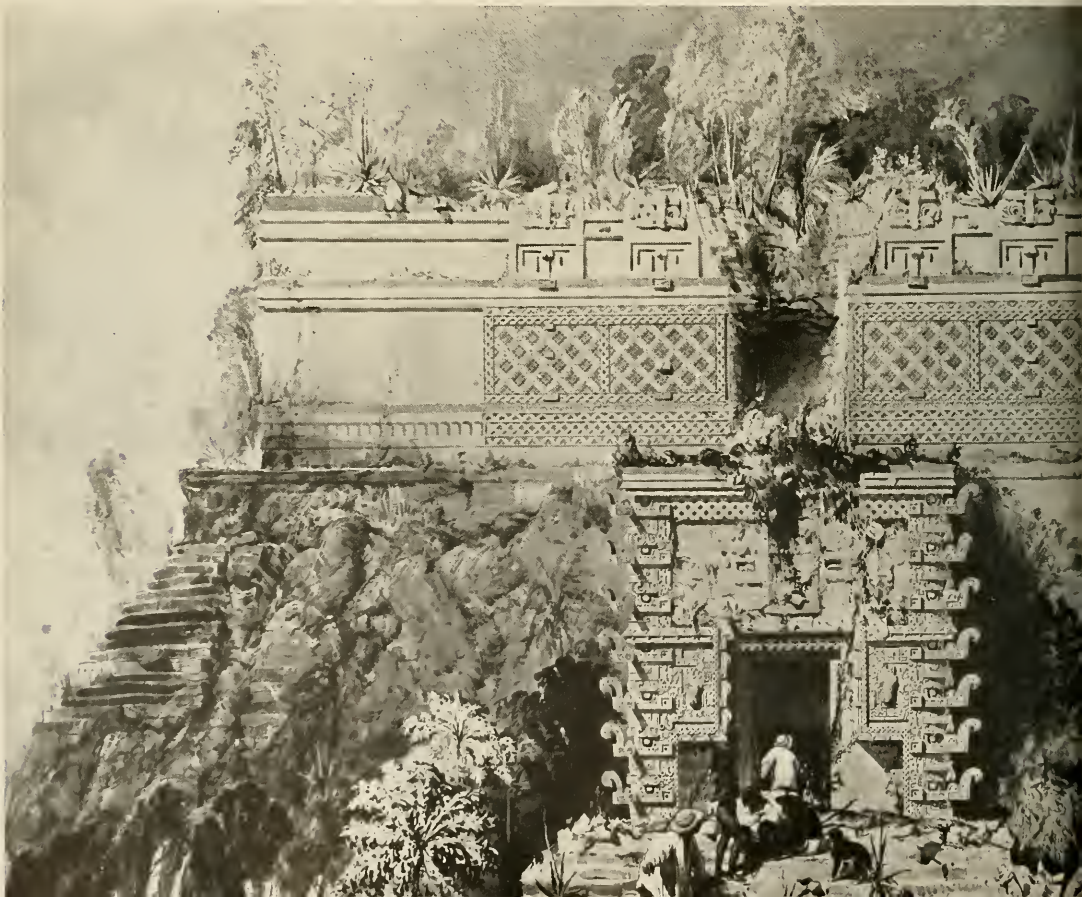
WALDECK

The life-story of one of the most extraordinary personalities ever to follow the lure of lost civilizations —explorer, soldier of fortune, artist, and fantasist

By Victor Wolfgang von Hagen

NATURE was lavish with Count Waldeck: she not only permitted him to be soldier, artist, explorer, courtier, revolutionist, and archaeologist, but in an outburst of prodigality allowed him 109 years of life to encompass them all. Yet in creating this almost legendary man—he lived from 1766 until 1875—, Nature left out an important ingredient, the critical faculty. And because of this lack, Jean Frédéric, Count de Waldeck, has disappeared into the limbo of half-remembered, half-forgotten men who helped to create the fascinating subject of American archaeology. For—to give a pioneer his due—Waldeck was one of the first to penetrate the green curtain of Central America's jungles in search for Maya ruins. He explored the unknown Maya sites of Palenque and Uxmal seven years before Stephens and Catherwood[1] undertook their classic investigations. Yet, by the time of his American adventures, Waldeck was already in the evening of his life, and he had by then—as Humboldt once said of himself—"lost all sense of the passage of time."

Waldeck's life opens like a picaresque novel. He was born March 16, 1766, in either Paris, Prague, or Vienna, depending on whatever city a biographer wishes to choose from the conflicting data. Of German *emigré* parents, Waldeck was a descendant of the dukes of Waldeck-Pyrmont, the tiny principality embedded in Prussian territory between Westphalia and Hanover. For centuries the Waldecks had been born in the shadows of the Hegekopf until—for reasons unknown—one branch of the Wal-



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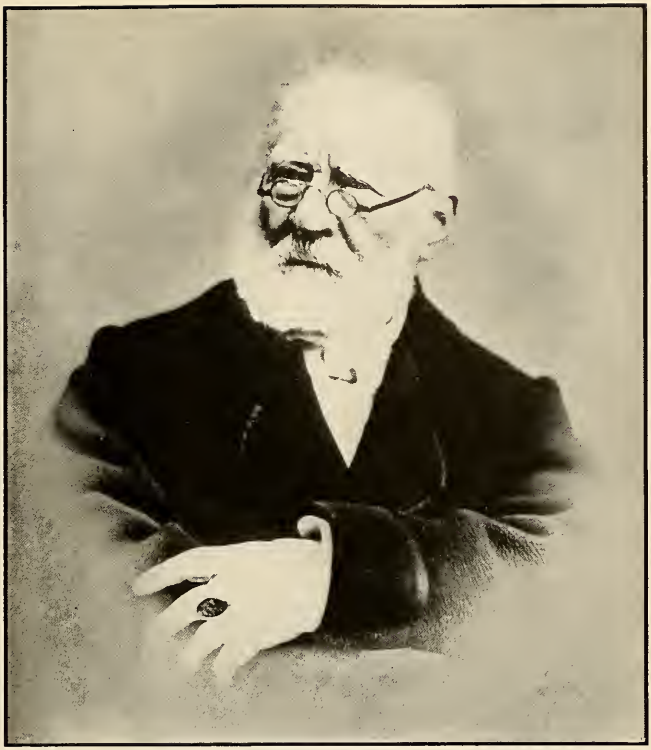
[1] See "The Strange Story of the Stephens Stones," by Carl C. Dauterman, in NATURAL HISTORY for December, 1939.

decks migrated to Paris. Nothing is recorded of Waldeck's early life. At 19 his life-adventures began; he was chosen to accompany François Le Vaillant on his second expedition to Africa, in 1786. Le Vaillant had previously been among the Hottentots. His first book, *Voyage dans l'Intérieur de l'Afrique,* published in 1790, contained fine plates of the giraffe, but it became notorious because of the figure of a naked Hottentot, which the authorities suppressed. Traveling with Le Vaillant, Waldeck earned the golden spurs of an explorer.

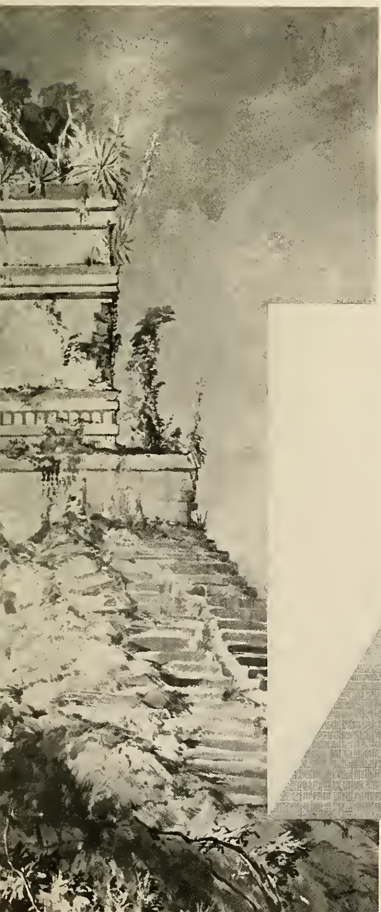
On his return to Paris he entered, as apprentice, the studio of the fa-

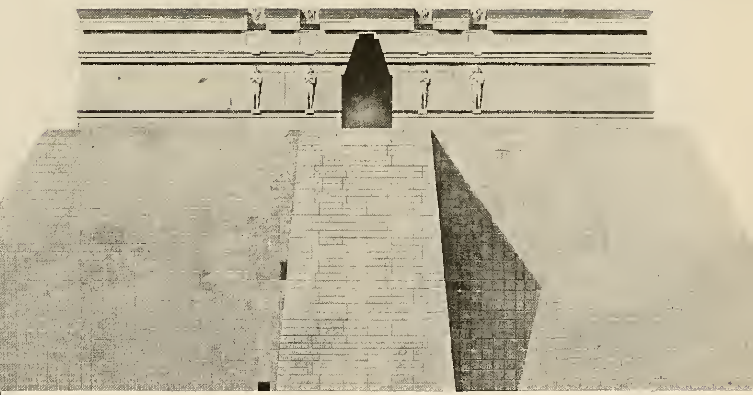


➤ WALDECK, photographed on his 100th birthday, shortly before he published his second book. At this time he was living on a 2000-franc pension given him by the Republic of France

Photo courtesy of the Edward A. Ayer Collection, Newberry Library, Chicago

FREDERICK CATHERWOOD'S accurate drawing (*left*) of the Temple of the Magician at Uxmal, Yucatán, reveals the extent of Waldeck's imagination. Actually the temple is situated atop a rough pyramidal mound about three times as high as the part shown here. But Waldeck's drawing (*below*), of which we show only a portion, portrays the pyramid as faced with smooth, finished masonry from bottom to top. And it omits entirely the startling gateway bordered by the long-snouted symbol of the Maya God, Itzamna





mous artist Jacques Louis David. In the atelier of David—famous as the court painter of Napoleon and the master of Audubon—Waldeck had his head filled with art-theory—and republican ideas. He took an active part early in the French Revolution, exhibiting with some courage a tricolor cockade in his three-cornered hat. As revolution swirled about him, he changed masters, entering the atelier of Pierre Prudhon just as the blood-stained besom of the revolution was sweeping up the debris of the *ancien régime.* After their majesties had deposited their severed heads in Monsieur Guillotine's basket and the crescendo of violence had produced—as a sort of reprisal—Napoleon Bonaparte, Waldeck became a soldier. He took part in the siege of Toulon and fought the campaign in Italy. A year later, in the capacity of "artist," he was attached to the scientific branch of General Bonaparte's Egyptian conquest. In that brief moment of French triumph, Waldeck looked upon the archaeological remains of Egypt and was entranced. He became so fascinated by what he saw and drew that when the French were defeated in 1801, Waldeck, instead of surrendering, fled up the Nile with four others as far as the cataracts of Aswan. They then started a trek across the Nubian Desert in an attempt to reach Dongola, Anglo-Egyptian Sudan. Everyone—except Waldeck—perished.

These youthful years had been years of violence. But time sped by, and at 40, Waldeck had nothing to show for his strenuous life. He had wanted to do archaeological drawing, but at every step he had been defeated by the realities of the moment. On his return to Paris, he found Napoleon emperor and the British holding the continent under blockade. Again the age of corsairs; and since a man of Waldeck's experience was greatly in demand, he sailed, in 1807, with Robert Surcouf, as an officer on the *Revanant,* to the Indian Ocean to prey on British commerce.

And now—a twist of the wrist and the bits of glass in the kaleidoscopic life of Waldeck have changed pattern. He is now, in 1819, in the Pacific—and fighting, at the age of 52, with the Spanish revolutionists. When Lord Cochrane—the famous lend-lease British Admiral—sailed to Chile on an ex-Spanish frigate renamed the "O'Higgins" *Citoyen,* Waldeck accompanied him. For the next two years he saw action along the coast of Chile, at the bombardment of Callao, and around the Robinson Crusoe-island of Juan Fernández. Then, on December 28, 1821, when Lord Cochrane's squadron put into the Gulf of Fonseca in Central America, Waldeck left the fleet. For some months he wandered in Guatemala. In 1821 he saw his first vestiges of Maya ruins. This was enough to arouse his interest, for when he arrived in England—carrying letters of recommendation from Lord Cochrane—, he received an assignment to illustrate the first book ever published on the Mayas.[2] This he accomplished by making copies of an earlier set of drawings of Palenque.

With this book, Waldeck was brought to the attention of Edward King, Third Earl of Kingston—known as Lord Kingsborough. A wealthy peer and an Oxford undergraduate, Lord Kingsborough had been suddenly flung into American antiquities—and the Mayas—by seeing a Mexican hieroglyphic tribute-chart in the Bodleian Library. Deeply interested, he began to collect from all sources then available everything known about the ancient American civilizations. Lord Kingsborough had a theory—neither new nor unique—that the American Indian had descended from the Lost Tribes of Israel. This anthropological obsession caused Kingsborough to publish over a period of years—between 1831 and 1848—nine huge volumes priced at £175. These books, *The Antiquities of Mexico,* were comminglings of fact, fantasy, legend, and fable, and they indirectly cost Kingsborough his life; he died, in 1837, in Dublin's debtors' prison for failure to pay a debt to a London papermaker.

In 1826 before the death of "milord," Waldeck sailed to Mexico under, as he said, the *"généreuse protection"* of Lord Kingsborough. He was engaged as an engineer at the British Mines at Tlalpuxahua, near Mexico City, the understanding being that he would scour the country on his Lordship's behalf for antiquities and "evidences of the lost tribes of Israel."

Waldeck arrived in Mexico in 1826, not as *citoyen* but as *Count* de Waldeck, accoutered in a velvet coat and a neckcloth of Brussels lace. There, for the next six years between mining operations, he painted backdrops for the theater in Mexico and explored all the archaeological remains in the Valley of Mexico. In 1831 he was given permission by Anastasio Bustamente, one of the *junta* ruling Mexico, to visit the ruins of Palenque in the jungles of the State of Chiapas. He obtained a *sauf conduit,* put together a small retinue of Indian retainers, resigned his sinecure at the mines of Tlalpuxahua, and departed for Palenque.

On May 12, 1832, at the age of 66—when most men take their ease—Waldeck erected a palm-thatched lean-to at the foot of the pyramid of the Temple of the Cross at Palenque and began to draw the Maya ruins. Palenque, constructed during the seventh century by the Maya of the *Old Empire,* had been built in the foothills of the Tumbala mountains, overlooking the flat Tabasco plains. There on the very edge of an outlying finger of a jungle-range, these Indian builders had reared a religious center of fantastic proportions. Palenque consisted of a number of temples built upon truncated pyramids and the so-called Palace, an architectural complex of many chambered rooms, grouped about four main courtyards, with a square tower which rose from its center to a height of about fifty feet.

Palenque is without a name of its own. The barbarically beautiful structures, with their high roof combs, moulded in stucco and riotously colored, are embellished with

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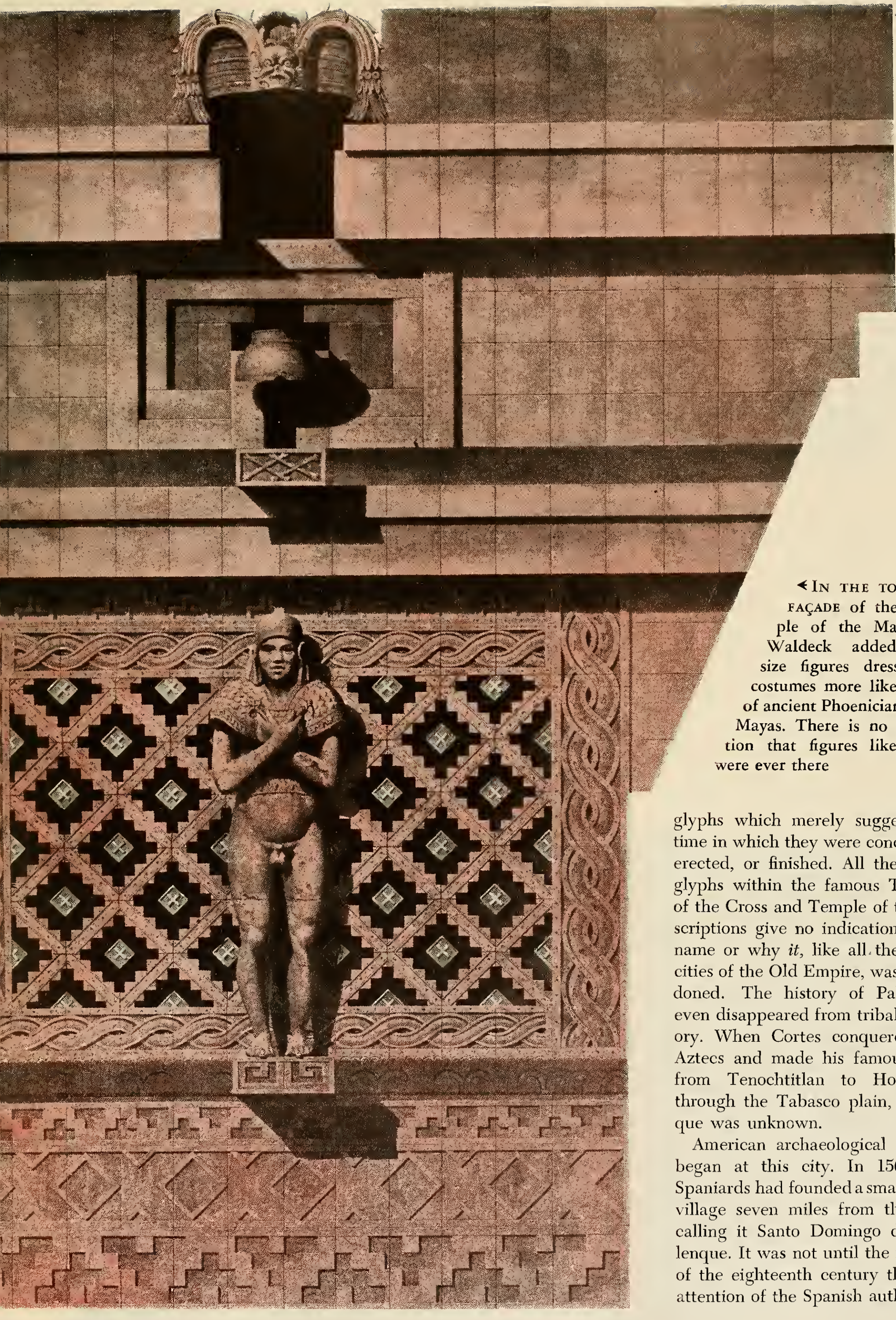
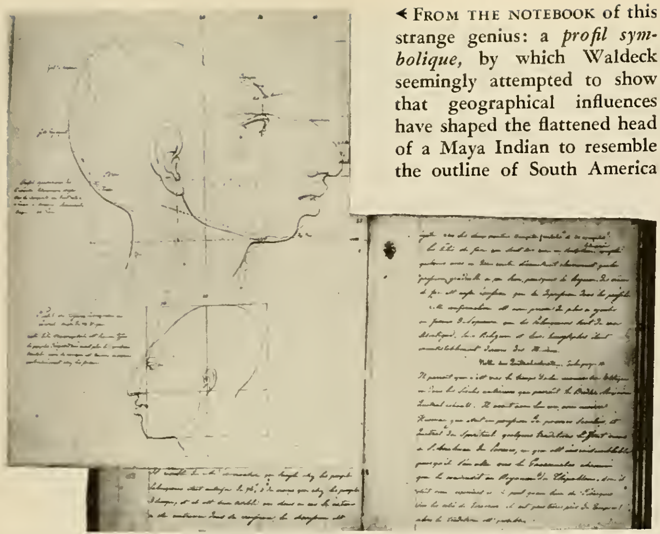
[2] *Description of the Ruins of an Ancient City Discovered near Palenque by Antonio del Rio,* London, 1822.



◄ IN THE TOPMOST FAÇADE of the Temple of the Magician, Waldeck added life-size figures dressed in costumes more like those of ancient Phoenicians than Mayas. There is no indication that figures like these were ever there

glyphs which merely suggest the time in which they were conceived, erected, or finished. All the other glyphs within the famous Temple of the Cross and Temple of the Inscriptions give no indication of its name or why *it,* like all the other cities of the Old Empire, was abandoned. The history of Palenque even disappeared from tribal memory. When Cortes conquered the Aztecs and made his famous trek from Tenochtitlan to Honduras through the Tabasco plain, Palenque was unknown.

American archaeological history began at this city. In 1564 the Spaniards had founded a small post-village seven miles from the site, calling it Santo Domingo del Palenque. It was not until the middle of the eighteenth century that the attention of the Spanish authorities



➤ **From the notebook** of this strange genius: a *profil symbolique,* by which Waldeck seemingly attempted to show that geographical influences have shaped the flattened head of a Maya Indian to resemble the outline of South America

Courtesy of the Edward A. Ayer Collection, Newberry Library, Chicago

was directed to the stone ruins that lay covered by the Tumbala jungles. Palenque (meaning "palisaded") was named from the village near by and was visited by many expeditions sent out by the King of Spain. Although the reports were never published—except the one illustrated by Waldeck in 1822—, rumor of the ruins drifted completely over the learned world.

For two years Waldeck weathered the tropical climate of Palenque, consoled, it is said, by a tantalizingly attractive *mestiza,* who shared his troubles and his pleasures. For two years he scrambled over the jungle-covered ruins, drawing in his finished style the remains of the Maya City. His drawings of the Maya sculpture—typically French period pieces—were beautifully done in the facile manner of a Jacques Louis David, but as archaeological drawings they were most equivocal. Waldeck invented, restored, and altered the original Maya designs. Some slight variation from the original is perhaps allowable—owing to the personal equation of an artist—, but inventiveness or artistic creativeness is, of course, looked upon by archaeologists as a major crime. A broken Maya stone head became, under the alchemy of Waldeck's brush, a vibrantly alive classic sculpture; a tumbled ruin was metamorphosed into a structure of finish and polish. The Indian character of the ruins was completely erased. "I have a soupçon," said the author of *The Conquest of Mexico,* "that Waldeck is a good deal of a charlatan . . . I should not like to be led into blunders by confidence in him . . . Waldeck's designs . . . are so little like the pictures of *ruins* . . ." William H. Prescott was right. Waldeck, in this sense, fully deserves the censure recently given his work by a Maya scholar who describes them as "a strange mixture of inaccuracy, unjustified restoration, over-drawing and exaggeration."[3]

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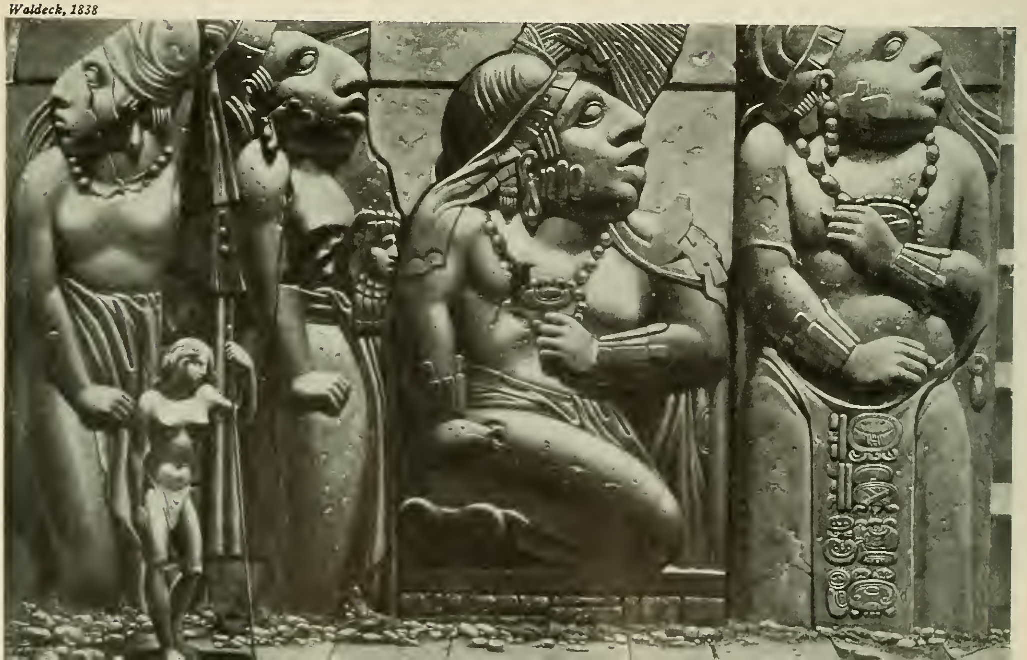
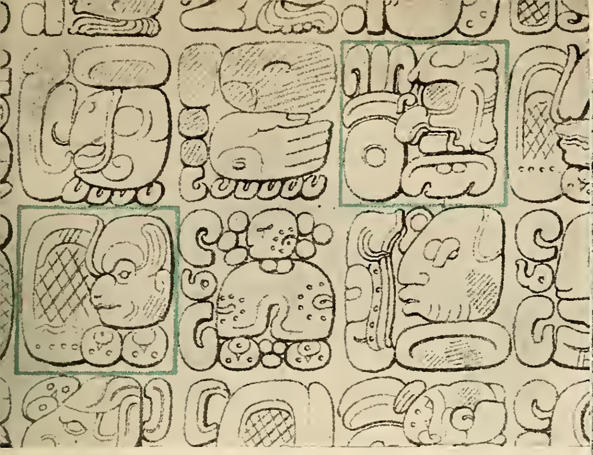
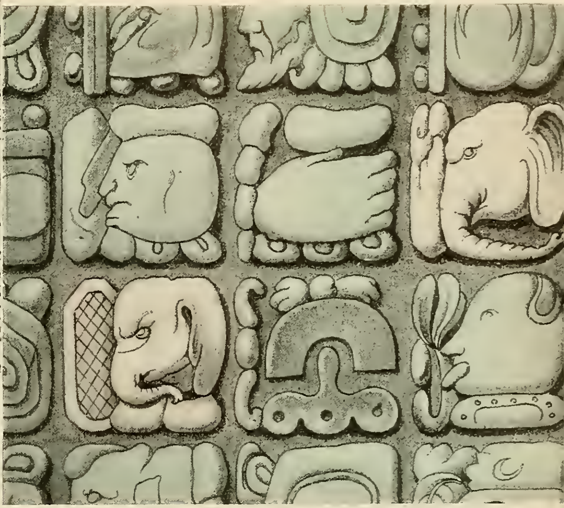
[3] H. E. D. Pollock, "The Study of Maya Architecture" in *The Maya and their Neighbours,* page 185, 1940.

➤ **Waldeck** was a skillful artist, and some of his drawings show reasonable resemblance to the original. In this one, he could not refrain from inserting the figure of the *mestiza* who stood by him through many of his troubles in the Central American wilderness

Waldeck, 1838







MAYA HEIROGLYPHS, as copied accurately by A. P. Maudslay (*left*) and imaginatively by Waldeck (*right*). Note the elephant heads that Waldeck imagined he saw in the symbols. Elephants were not known to the inhabitants of Central America, and Waldeck's inventiveness unfortunately led many persons to believe that the Mayas had brought knowledge of them from Asia

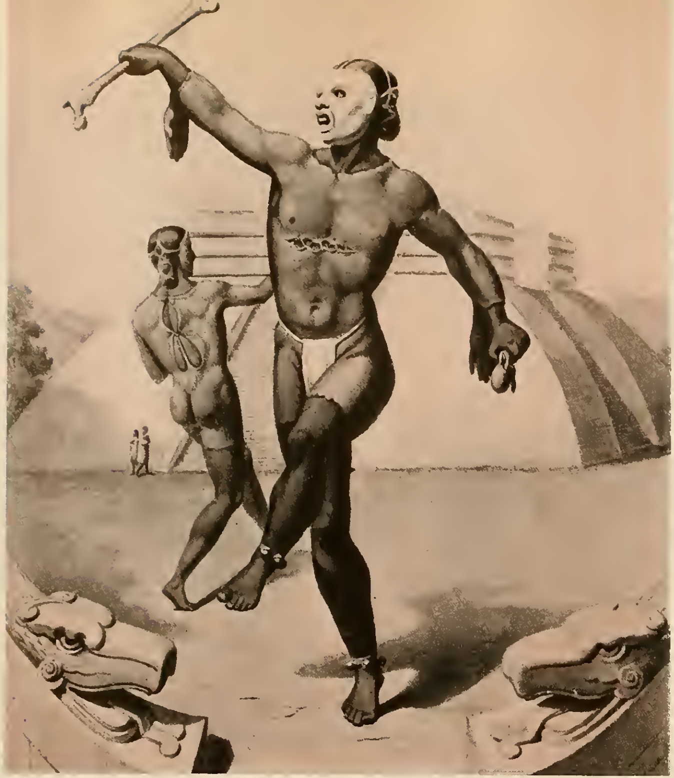
But this does not hold for all of Waldeck's work. He was a pioneer, threading his way through the labyrinthine complications of a civilization then without a name; and to give him a further apologia, he was under the influence of the current misconceptions about the American Indian. His drawings of natural history, and of the people themselves, are something else again. As one leafs through his original journals, now reposing in the Edward E. Ayer collections within the Newberry Library at Chicago, one can see the protean manifestations of his interests. At one place he attempts to unravel the Maya glyphs; at another, under the obsession that the shape of the head denotes mental faculties, he distorts Maya profiles to fit the outline of the South American continent! At Palenque he conceived a plan to write an entire history of Ancient Mexico in three parts: 1) The Ancient History of Mexico, 2) The Ruins of Palenque, and 3) The Voyage to Yucatán. In anticipation of this, he drew his Indian *mestiza,* in the nude, in many attitudes, with Palenque as a background, for he had, as explained by John Lloyd Stephens (who attended her funeral in Palenque many years later), taken her portrait "to embellish his intended work on Palenque." Then in the midst of all these speculations—trouble.

Adversity came to Waldeck in the person of the Mexican police. The celebrated and terrible-tempered Mexican general and president, Santa Ana, suspected this French artist of political intrigue and put his agents upon him. In 1834 the police fell on Waldeck at Palenque. They sequestered all his drawings and ordered him from the ruins. He fled to Campeche, where he came under the protection of the British Consul. But after what he considered a violent diatribe against him, he fled from Campeche to Yucatán.

On December 21, 1835, Count Waldeck—now approaching 70—arrived in Mérida. There displaying the sketches of the original drawings that Santa Ana had taken from him, Waldeck secured permission to visit the then mysterious ruins of Uxmal which lay some miles distant from Mérida. With a passport signed by Lopez de Llergo permitting him *"para Viajar todos los pueblos del estado,"* Waldeck went to the ruins of Uxmal.

It is unfortunate for archaeological science—and for Waldeck's reputation—that he was possessed of so much imagination, for under his investigations, Uxmal, one of the most famous of Maya ruins, lost all identity with the original. The Temple of the Magician, one of the most barbarically beautiful of all Maya edifices, became, under Waldeck's brush, a pyramidal structure bearing not the slightest relation to the original. On the apex of the truncated pyramid he drew a finished structure, decorated with life-size figures of men, carved of stone in the full round, accoutred in the costumes of ancient Phoenicians. These figures he called "caryatids," and he assured his readers that they were *"la coupe exacte."* One has only to compare the superb drawing that Frederick Catherwood made seven years later of the same Temple of the Magician to see why Waldeck has been placed in an archaeological limbo. And, too, Waldeck saw elephants—not the bones of the mastodon, which have been found in Central America, but the carved heads of elephants—which he claimed the builders of the Maya ruins had developed as a decorative motif. It was unimportant that actually there never existed such designs; Waldeck imagined them, so he drew the elephant heads.

This gave substance to ideas long current that the American Indian was actually a Mongol. One English writer went so far as to say that these Mongols brought elephants to America with them in the fourteenth century. This "dispersion"



Courtesy of the Edward A. Ayer Collection, Newberry Library, Chicago

▲ AT 98, WALDECK was still a remarkable artist, as shown by this drawing of Aztec priests dancing in the flayed skins of their sacrificed victims. Note the femur bone in one hand, and the victim's heart in the other

school of anthropology has prevailed in some quarters down to the present time, and Sir Grafton Smith is the high priest of the cult. His theme is that the Mayas, "children of the sun," spread from Egypt across the world, disseminating their system of beliefs through India, Cambodia, and Polynesia. These people, he reasons, reached America, and hence Yucatán, by outrigger canoes. Sir Grafton does not believe that elephants actually reached America, but that the idea of the elephant, personified in *Ganesa,* the elephant-headed god, was transmitted down the centuries to the Mayas and that they, in decorating their stone palaces, actually carved the *Ganesa* elephant-headed god. His book, *Elephants and Ethnologists,* which is based on some of Waldeck's fantasies, undertook to prove that the Maya structures were built by an invading force from Cambodia in historical times. This began a vituperative controversy.

When Eric Thompson, the accomplished Maya scholar, discovered Waldeck's drawings of elephant heads, copies were sent to Sir Grafton as a jest. And he, claiming that they were the final proof of Asiatic influence in America, demanded the right to publish them. Mr. Thompson refused on the basis that Sir Grafton would give undue prominence to Waldeck and that this would muddy the anthropological water. After a protracted correspondence, Sir Grafton published the drawings in the *Illustrated London News* and wrote a letter to the *Times.* For weeks thereafter the letter columns were torn with the controversy—all beginning over Waldeck's "elephant heads."

In 1838—at the age of 72—Waldeck published his first book, *Voyage pittoresque et archéologique dans la province d'Yucatan,* a large folio volume illustrated with hand-colored lithographs. Dedicated to Lord Kingsborough, it was awarded the gold medal by the Société de Géographie. But time, which alone makes masterpieces, has in final judgment placed it merely among archaeological curiosities. Yet error is not necessarily error if it inspires truth. Waldeck's folio was one of the books that John Lloyd Stephens read, and one of the inspirations for his Central American tour.

And Waldeck?

Waldeck lived on and on to be a veritable Methuselah. When he was eighty-four, he married an English girl of seventeen and sired one son, whom he named Gaston. Surrounded by the mementos of his travels in his house at No. 2 Chaussées des Martyrs, in Paris, he watched the growth of interest in American antiquities, an interest for which he had been partly responsible. He read the books of John Lloyd Stevens and saw the accurate engravings of Frederick Catherwood.

He could not have but winced when he read, in the *Conquest of Mexico,* William Prescott's scathing criticism of his archaeological inventions. But it did not affect him. When he was a hundred years old (and this should be an inspiration to aspiring authors), Waldeck published his second book. It did nothing to enhance his reputation, for scholars had before their eyes the drawings of Frederick Catherwood when Count Waldeck released his archaeological fantastia of the ruins of Palenque. Age had not brought wisdom to Jean Frédéric.

There is a final episode.

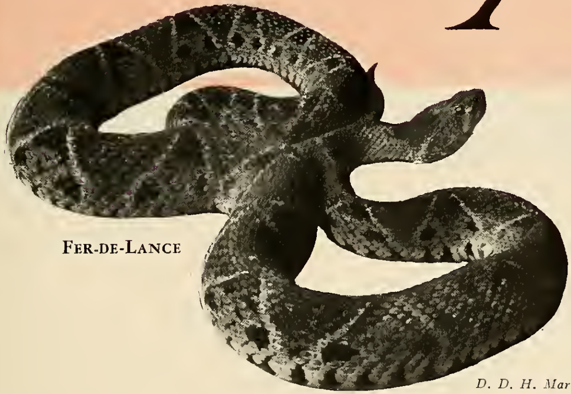
On the 29th of April, 1875, when he was walking down the Champs Elysées, Waldeck turned to look at an attractive girl and was felled by a stroke. Thus, there ended on the streets of Paris, where it had begun one hundred and nine years before, the fantastic life of Jean Frédéric, Count de Waldeck, the first Maya archaeologist.

Enlarged from a chapter in the author's manuscript John Lloyd Stephens, an Archaeological Biography. *To be published in the spring of 1947, by A. A. Knopf.*

"X"

Poisonous at birth and attaining a maximum length of over eight feet, it probably causes more deaths than any other reptile of the western hemisphere

By Paul L. Swanson



Fer-de-Lance

D. D. H. March photo

THE letter "X" may mean any one of a number of things, depending on how you look at it. To a mathematician it represents an unknown quantity. It may mean ten, or in a tabloid photograph it may mark the spot where the body was found. I once knew a Pennsylvania Dutchman to whom "two X" meant breakfast. To an etymologist it is a poor letter with which to start a word. To a love-sick correspondent it symbolizes a kiss. But to a naturalist with a memory of rural Panama, it has a much more sinister meaning, for there it is the succinct appellation of a deadly serpent.

This simple name has been given the snake because of the X-shaped markings on its back. The Spanish pronunciation of "X" is *equis,* or in English "EH-kees." The snake bears many other descriptive names in Spanish, Portuguese, and Indian, in various parts of its range, but the accepted English name, paradoxically, is French. For the French creoles of Martinique originated the name by which it is known to most of us: the fer-de-lance ("the iron of a lance").

My introduction to this scourge of the tropics was a memorable affair. As I look back upon it, I realize how true it is that a little knowledge may be more dangerous than none at all, as the following experience will indicate.

It was on Barro Colorado Island in Gatun Lake—that naturalist's paradise where you can see more of tropical wildlife in a day than you could in a week on the mainland. I was walking down a rather steep hill. Astraddle my neck was the three-year-old daughter of two of my friends. Following me, in single file, were her parents, another man, and an army nurse. The nurse, who was immediately behind me, rather casually remarked: "You have just stepped over a snake."

My thrill in the prospect of adding another snake to my collection was marred a little by chagrin at not having been the first to see it. I was the one who was supposed to be the herpetologist. I excused myself with the thought that perhaps baby Ethel had diverted my attention. I looked back, and there, in a neat coil right on the trail, was a snake which I had no trouble in recognizing as a fer-de-lance, or *Bothrops atrox.*

Handing the girl to the nurse, I got out my camera. I had photographed rattlesnakes scores of times and believed that I knew enough about the temperament of a snake to predict its actions reasonably well. This snake was definitely in a quiescent mood. If he were not unduly disturbed, I should have no trouble in getting a good photograph. I approached from the down-hill side, and with the lens 3½ feet from the center of the coil, as nearly as I could judge it, I snapped the shutter. I took a second photo and pocketed my camera.

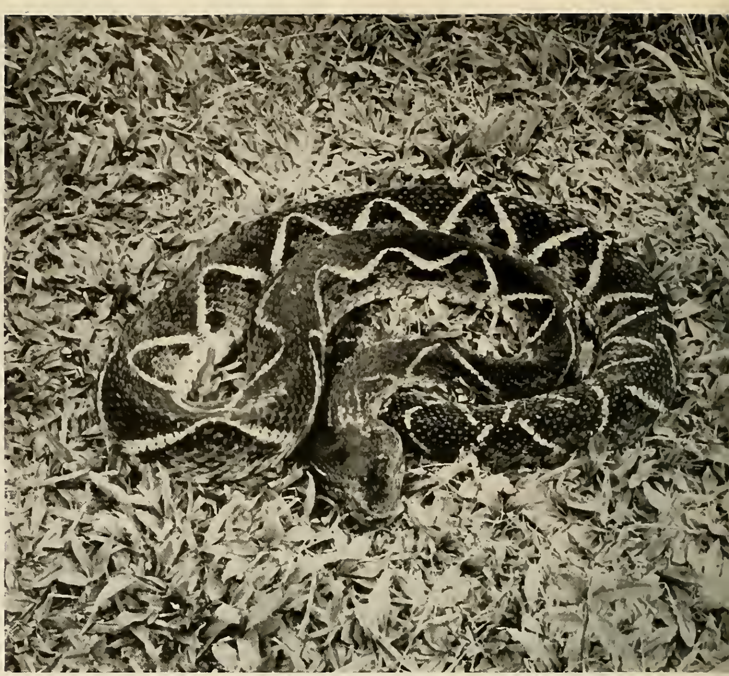
Then I looked for some sort of a stick, and soon found a dead section of a branch about two feet in length. Pressing this against the neck of the snake, I grasped it by the neck and worked my hand up close to the head before releasing the stick. I held up five feet of squirming fer-de-lance.

It is well to know that when men are traveling single file along a trail, the leader is less apt to be struck by a snake than one of those following. The snake is alerted by the leader, and by the time two or three men have walked by, it is excited enough to strike at the next movement it sees. In one such case with the fer-de-lance, the third man was bitten and died in a short time. Once in Florida, three other men and I had passed a cottonmouth moccasin that was resting at the edge of the path. We might not have noticed it at all, but the slight "pop" it made when it opened its mouth attracted our attention as the fifth man was going by it. It is possible that my Barro Colorado Island fer-de-lance might have struck at one of my friends if the nurse had not called attention to it.

I hooked the fangs of the fer-de-lance over a stick and milked out a surprisingly large quantity of venom from it. Besides providing my friends with a little exhibition that they had not witnessed before, it rendered the snake much less dangerous in case of any possible accident.

I made a makeshift sack of my undershirt, and we carried the fer-de-lance back to the laboratory, where it was kept alive for some time. It subsequently gave birth to twenty or more young. This event was unexpected. The mother was in a cage made of half-inch mesh wire, and it was no wonder that many of the snakes were found crawling around the laboratory floor!

When I got back to the United States, I read a number of interesting accounts of the fer-de-lance and found convincing testimony regarding its unusual temperament. Instead of being nervous and irritable like a rattlesnake, it is rather phlegmatic and does not bother to put up the rattler's antagonistic display of defense. Instead of rearing the fore part of its body and exhibiting alertness, it quietly waits until its enemy comes within range and then strikes deliberately. If I had suspected as much on Barro Colorado Island, I certainly would not have taken photographs within 3½ feet of a five-foot fer-de-lance!



▲ IT IS NOT nervous and irritable like a rattlesnake but waits patiently and strikes deliberately. The X-shaped pattern that gives it the shortest name of any snake may not be easy to distinguish against a leafy background

Although I did not realize it at the time, my supposition that because the fer-de-lance was not showing any resentment at my proximity it was not in an ugly mood, probably was a dangerous one. It recalls an experience I once had while collecting copperheads in Pennsylvania. I had just put a second specimen into a thin muslin sack, when I felt a sharp jab on my little finger. I looked around, but saw no berry bushes in the thick vegetation surrounding me, nor any other plants with thorns. I noticed a drop of blood on my finger, and a drop of amber-colored fluid near the top of the sack. It dawned on me that one of the copperheads had struck at me through the sack and had succeeded in placing one fang in my finger! Up until that time, I *knew* that snakes wouldn't bite through a sack. I had often carried such sacks in my belt, rubbing my thigh with every step. There's one born every minute! Perhaps one dying every minute.

The secret of getting along with snakes is never to make any sudden motions, but I had stepped right over that fer-de-lance, or at least very close to it. Perhaps it might have been sleeping; if a snake ever sleeps; *¿Quien sabe?*

The fer-de-lance is found on the island of Martinique, and one story has it that it was brought there to discourage slaves from wandering from the plantations at night. The eruption of Mt. Pelée in 1902, which took a high toll of human life, was supposed to have eliminated great numbers of these serpents as well. Another factor that probably helps to keep the fer-de-lance population down is a certain procedure followed in the cutting of sugar cane. When cutting a field of cane, the men work toward a predetermined corner. The commotion caused by the laborers in cutting causes the snakes to retreat toward that corner. When only a small patch of cane remains, it is set on fire from all sides, thus killing the snakes that remain in the field.

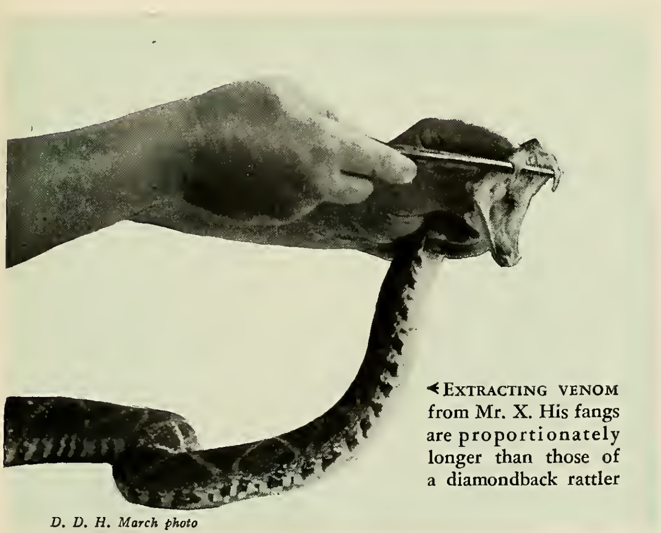
The fer-de-lance is also found on St. Lucia, Tobago, and Trinidad, but it is absent from most of the other islands of the West Indies.

The mongoose was brought to Martinique, St. Lucia, and Trinidad more than 60 years ago to destroy the snakes, but there is no evidence that it will attack a viperine snake, and it is generally agreed that the importation of the mongoose was a serious mistake. The mongoose preyed on the birds, including poultry, but made no apparent dent in the population of *Bothrops atrox.*

The fer-de-lance is found in the lowland tropics from San Luis Potosí in Mexico to Missiones in northern Argentina. The adult ranges from about four feet in length to a little over eight feet. Like most snakes, it attains a larger size in some parts of its range than in others. In Honduras a specimen 8 feet 4 inches long was taken, but a 6-footer is probably large for Panama. They do not have the weight or girth of our big diamondback rattlers of equal length, but the fangs of the fer-de-lance are proportionately longer.

The female gives birth to very large numbers of young for a pit viper. One brood in Honduras numbered 71. These young snakes have a yellow tip to the tail, similar to that of the copperhead of the United States. Wriggling the tail may be a method of attracting lizards for food, the latter thinking it some sort of larval insect or worm. The young are born with the fangs developed and are capable of inflicting poisonous bites. Their habit of climbing bushes and trees, coupled with a vicious disposition, is responsible for many snake-bite accidents. Fortunately the adults are content to remain on the ground and are most active at night.

The food of the adult fer-de-lance consists of small mammals, particularly such species as the opossum, which is nocturnal like the snake. Lizards also form a portion of the diet of the fer-de-lance.


◂Extracting venom from Mr. X. His fangs are proportionately longer than those of a diamondback rattler

D. D. H. March photo

As is the case with many other snakes, the fer-de-lance is often more numerous around human habitations than in the jungle or forest. The accumulation of trash heaps around the plantations, and refuse from native houses, afford both food and cover for rats and other small mammals; these in turn attract the snakes, which find them an easily procurable source of food.

Douglas March, who himself met death from the bite of a fer-de-lance, reported a case from Honduras in which a native was bitten by one of these snakes. The man's wife bathed the fang punctures, which bled profusely. Her fingers had many cuts and scratches, received from a coconut grater. The man died in a couple of hours, and the woman the following morning, presumably from the venom that had entered her broken skin!

There is not much doubt that the fer-de-lance has been responsible for more snake-bite deaths than any other snake in the western hemisphere. In one part of its range, it is known as the *mata caballo* ("kill horse"), and quite probably it is responsible occasionally for the death of a horse or a cow. A more common name for it in Mexico is *cuatro narices* ("four nostrils"), the pits being mistaken for an extra pair of nostrils. It is also called *rabo hueso* ("bony tail"), owing to the yellowish tail. The names *barba amarilla* ("yellow beard") and *terciopelo* ("velvet skin") are frequently used in various parts of Central America. There are, in addition, a wide variety of other names, so you may be quite content to call this serpent Mr. X.

While the danger from this and other poisonous snakes should not be minimized, the tropical traveler may be comforted to know that his chance of encountering a fer-de-lance on his visit is probably a great deal less than that of meeting a diamondback rattler or cottonmouth moccasin in Florida. If by chance you are one of these few who are not particularly terrified by snakes, you may be disappointed at seeing so few of them in the tropics.

Let's Build a SNOWHOUSE

It's not something that only an Eskimo can do, and besides being a lot of fun, you may find the skill useful on a winter hike

By Belmore Browne[*]

BACK in the old days, Harry Karstens and Tom McGonigal were driving their respective dog teams down the Yukon to the Tanana. Karstens, the "Seventy Mile Kid" as he was called, then cut cross-country to the Tanana to pick up some moose meat in a cache they had built. Tom kept on to the junction of the two rivers, for his dogs were below par and the water level route was the easiest.

After heading up the Tanana, Tom's team broke through an overflow and in a split second man and dogs were floundering in slush at 40° below. Countless men have died from similar accidents, but Tom didn't figure on "cashing in." Cutting loose one of the dogs that couldn't pull, he dragged the sled and dogs to firm footing. For a moment man and dogs rolled in the soft snow to absorb the water, and then he started them on the run for the river bank. As he ran, Tom thought hard and by the time he reached the bank his plans were made.

Cutting the sled lashings, he brought out dry socks and moccasins, and cutting his frozen moccasin lacings, he made the change at desperate speed. Frozen willows were in sight, but some lusty pulls tore the handle bars of his sled loose and with the aid of the candle that the old time dog-mushers always carried he soon kindled a blaze. With his legs and feet dry and some hot tea warming him, he was safe . . . for the moment.

Shelter for the night was the next essential, and his tent was on Karsten's sled. His eye caught a deep snowdrift by the river bank. Without wasting a second, he began digging a cave, using a snowshoe for a shovel. When the cave—a small one—was completed, he dragged in his tarp and blanket of twisted rabbit fur, called in two of his dogs, rolled them and himself in his bed, and slept warmly through the night of bitter cold.

In the telling, it all seems logical and easy, but in a liftime of northern experience, it is the only case the writer knows of where a white man caught in such an emergency has used snow to keep himself warm. Practically everyone knows that bears hibernate in snow caves, that the ruffed grouse spends the night buried in soft snow, and that the Eskimo lives in domed snowhouses; but with the exception of Stefansson, Peary, and a few other arctic explorers, the white man has stubbornly refrained from using snow to increase his comfort or save his life.

Late in the winter of 1943, the Lovat Scouts were undergoing transformation from a Commando to a Mountain Regiment. The officers, Scotch and English, had been well chosen for such a command. Included in their number, were men who had camped and climbed among the snow peaks of many of the world's great snow ranges.

During a field trip, a group of these officers and the writer found themselves at nightfall on the frozen surface of Maligne Lake, high in the Canadian Rockies. The long blue shadows were reaching outward from the wall of snow-covered mountains to the west. You could feel, by baring your hand for a moment, that the temperature was well below zero, and from the look of things, it was going a lot lower. From an emergency camping point of view, the outlook was grim.

Lt. Col. Frank M. Smythe gave voice to the only answer. Turning to the writer he said, "Now's the time to try out that igloo you were telling us about."

The Eskimo snowhouse (*igloo* in the Eskimo language means any kind of shelter whether in winter or summer) is usually built of blocks cut from wind-pressed snow. Such a block is solid, strong, easy to cut, and, because of its low moisture content, a nonconductor of cold. In this case, however, the snow covering the lake had been subject to repeated changes in temperature and consequently had turned granular—"corn snow" mountaineers call it. In addition to its relative coldness, corn snow at best is friable, and a treacherous building medium. But on cutting a trial block, the snow seemed to possess enough cohesion to make the experiment worth while. None of the men present, with the exception of the writer, had ever taken part in the building of a snowhouse, or even seen one constructed. However, the team of Scotch and English block-cutters fell to with a will.

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[*] At the age of 9, the author was living in lumber camps and on ranches. In 1900-02 he served as artist and collector on Andrew J. Stone's Alaskan Expeditions and has since made countless expeditions into the Northwest, traveling with various Indian tribes. He surveyed the boundary for Mt. McKinley National Park, secured the largest Alaskan bear scientifically measured, and captured Ivan, the famous Brown Bear of the Bronx Zoo. In 1921 he built a home in the Canadian Rockies, where he spent 21 summers and parts of winters painting wildlife from Mt. Assiniboine to the Athabaska River. His work is represented in the National Gallery and in other exhibits, and his collections have enriched many museums. He is the author of *The Conquest of Mt. McKinley*, several other books, and many magazine articles. He is a leading authority on woodcraft and camping.—Ed.

The first tier was soon in place and the spiral dome began to take form. Many of the blocks broke, but in less than 50 minutes the "king block" had been fitted into place, the cracks between the blocks had been fitted with small blocks and soft snow, and the house was ready for occupancy.

The entrance door should ordinarily be made beneath the level of the floor, permitting the cold air to settle in the door tunnel and thus increasing the warmth of the upper portion. In this instance, the snow on the lake was only about one foot deep. Therefore, a snow-level door was the only choice.

The furnishing of the snowhouse was a simple matter. We laid a canvas tarp on the floor, unrolled our sleeping bags, and placed our rucksacks at the head. The door was closed from the inside with a snow block, and we were "at home."

What had the snowhouse accomplished for us? Col. Smythe, a member of three Everest Expeditions and a man whose experience and interest in cold weather procedure was based on many years of high altitude camping, took over the temperature readings. On entering the snowhouse, he found it was 27° below zero. In addition, a night wind was "making." The surrounding wall of ice- and snow-covered mountains formed a gigantic funnel through which the winds from the higher peaks were beginning to siphon in a frigid gale. But within the snowhouse not a sound of the gale could be heard, and a lighted match burned unwaveringly with a bright, steady flame. Frank removed his parka and gloves—it was beginning to get warm! For 20 minutes we rested and talked in complete contentment; then Frank took another temperature reading. "I can't believe it," he said, staring at the thermometer, "but the official temperature is now 33° above zero—one degree above freezing!"

Put in another form, in twenty minutes our body heat alone had brought the temperature up to a point where men could live through a night of subzero storm with no other protection than their clothing. There is no other man-made,

▼ **Ready to cook dinner** in a snowhouse from which the roof has been cut away for photographic purposes: a scene at 11,000 feet in the mountains of Colorado

◄ THE BED PLATFORM is three feet or more above the floor

emergency shelter that can duplicate this feat, except the snow cave.

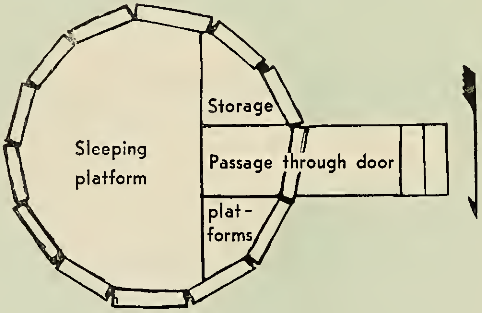
After our period of relaxation, hot tea and a bedtime snack seemed the proper move. Our only artificial heat consisted of an "Aladdin" lamp—a small gas-vaporizing stove issued to mountain troops by the U. S. Quartermaster Corps. Filling a pail with snow from the floor of the snowhouse, we put it over the flame to melt. In a minute or two the rise in temperature caused by the small flame became apparent. Off came our fur caps and mukluks, and before we realized it we were enjoying all the warmth we could wish for.

After the Aladdin lamp had burned for 20 minutes, Frank read the thermometer again. As on the previous occasion, he studied the instrument with a look of astonishment. Then, with a note of surprised conviction, he said: "Believe it or not, it's 65° hot!"

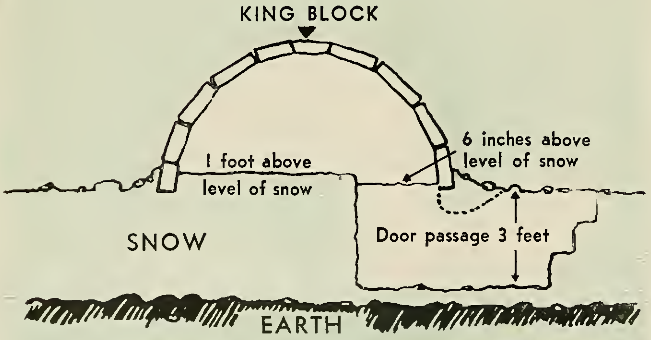
That night we slept with our sleeping bags unfastened and the upper flap drawn loosely over our shoulders. Men could not have slept more comfortably. On subsequent occasions relays of officers passed the night in the snowhouse, and they invariably expressed their amazement at the warmth and shelter enjoyed.

Why is it that the warmest, strongest, most dependable, stormproof emergency shelter known has remained practically unused by northern outdoor men the world over? On the Byrd expeditions to the Antarctic—the most lavishly equipped and costly ventures ever organized—not one member could construct a snowhouse. Byrd's dog-drivers were equipped with fabric tents, which in a subzero storm are not even efficient windbreaks. Lt. Col. C. A. K. Innes-Taylor told the writer that when he was in charge of the dogs, the bitter cold endured by the men—within the tents—affected them mentally and physically. Had snowhouses been used, with the same equipment and under like conditions, they would have

GROUND PLAN OF SNOWHOUSE



SIDE ELEVATION



➤HERE THE UPPER BLOCKS were placed irregularly to show how time can be saved when haste is urgent. The well-known Arctic explorer Stefansson, instructing troops of the U. S. Army, is seen inside the almost finished house

enjoyed perfect comfort. And the best quality of snow for snowhouse building is common in the Antarctic.

At the outbreak of World War II, the writer was appointed adviser to the newly formed Arctic Training School of the U. S. Army Air Force. In this work, Vilhjalmur Stefansson was wisely awarded the role of Adviser on Arctic Procedure. First by the use of diagrams and later by the actual construction of a snowhouse, he inducted the writer into the art of snowhouse building. Since then, the writer has made snowhouses under all sorts of conditions. Some of them have been unorthodox, such as by forming blocks from soft spring snow or even "powder snow" (prevalent throughout the subarctic in winter) by tramping the snow evenly with snowshoes and allowing it to solidify overnight. This experience shows that wherever snow exists it can be formed into a snowhouse by the use of patience and a slight amount of ingenuity. From the wet, heavy snowfields of the Sierras and lower Appalachians to the dry snow of the northern states, the snowhouse can be built and has proved its usefulness in many ways.

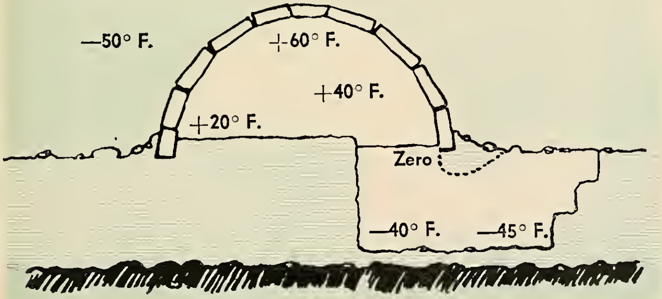
During the long periods the writer spent on the snowfields of Mt. McKinley, especially during 1910 and 1912, subzero temperatures were often recorded within the tents. In addition to the tents, we carried a shovel with which to make holes in the steep slopes in which to pitch our tents. The snow blocks that we removed were of the finest quality for making snowhouses, yet we never thought of using them. If we ever did consider it, the thought in our minds was that only Eskimos could build snowhouses and that their construction required a lifetime of experience in the "polar wastes." Nothing could be farther from the truth.

The principle that makes the snowhouse possible is the spiral dome, based on a circular inclined plane. The Eskimo alone among all mankind has discovered how to build a dome without scaffolding. Yet an understanding of this principle and a little experience in its application covers all the secrets of snowhouse building.

The inclined plane is cut in the first tier of blocks. Thus the succeeding tiers rise in a spiral formation. This enables each block to be supported on two sides—on the bottom and on the side resting against the block laid before. This in turn enables the walls of the snowhouse to lean inward without falling. Care must be taken that the block rest only on its two lower corners. If the center of the block rests on the tier below, it will twist on the fulcrum thus formed and fall. Because the walls slope inward, the builder must stand within the circle of blocks, facing outward. Each block as it is placed, rests on its two lower corners as stated above, and in addition, one of its upper corners impinges against the upper corner of the preceding block.

In the curve of the dome, where the blocks lie almost horizontal, cohesion comes to our aid. Every-

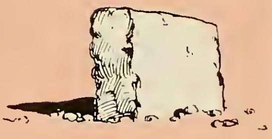
The colder it is outdoors the warmer it can be made in the snowhouse without melting the roof. If it is as cold as 50° below, the temperatures indicated in the drawing are possible, according to Vilhjalmur Stefansson



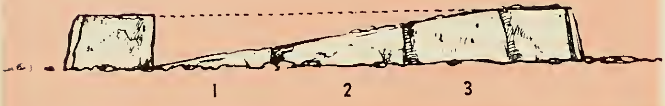
STEPS IN CONSTRUCTION OF SNOWHOUSE

Blocks of snow are cut about 3 feet long, a foot and a half wide, and six inches thick

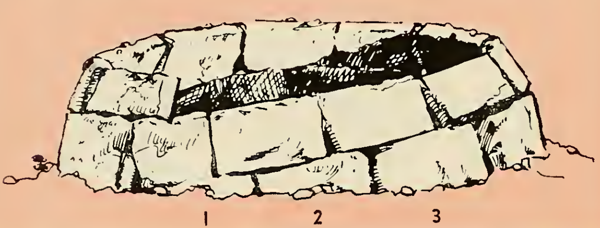
The blocks in the first tier are placed nearly perpendicular



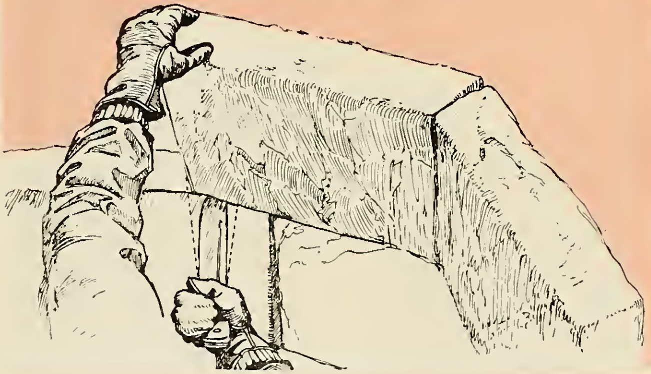
First tier completed, showing three blocks cut to form an inclined plane



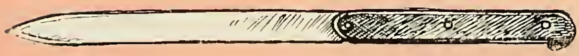
Second tier, showing continuation of spiral formed by inclined plane



THE ONLY TRICK IN SNOWHOUSE-BUILDING. Shaving down the corner until it "packs" against the preceding block. If the snow is of good quality, this may not be necessary



The snowknife should be about 27 inches long. Any large butcher knife will do



one knows that two handfuls of snow can be clapped together to form one piece. In a similar way, each block adheres to the one next to it. When a block is being laid well up in the roof of a snowhouse, it can be made more secure by a simple trick. Slide the blade of your snow-knife gently back and forth under the corner of the block farthest from the block you just laid. The block then settles a quarter or a half inch with a slight crunch and becomes more firmly joined to the block next to it. This simple procedure, which can soon be mastered, is the only trick in snowhouse building; and if the snow is of a good quality you may not even need to use it.

The writer once built a snowhouse for the instruction of a group of army engineers who were bound for the North. "The use of the inclined plane? Sure—any one would savvy that much," were the opening remarks, but as the dome took shape and each succeeding block tilted farther inward until the 45° angle was safely passed and the final roof blocks lay almost level, a burst of incredulous laughter broke from the group, and cries of, "It can't be done!" "It's against the law of gravity!" filled the air.

As the engineers were on the outside of the snowhouse, they could not see the method or the effect of shaving down the free corner and fusing each block in turn. When the procedure was demonstrated to them, their incredulity changed to admiration of the "Unknown Eskimo" who had discovered the process.

While any long-bladed knife, such as kitchen bread knife, can be used for cutting snow blocks, it follows that a longer blade and handle are preferable. The snow-knives used by the Arctic Training School of the Army Air Force were about 27 inches overall, and the thin wooden handle was about 11 inches long. A knife of this length can easily be forced under an 18x30 inch snow block, which is about the average size used. Such a block, six inches thick, when cut from wind-pressed snow, will weigh about 65 pounds and is strong, easy to shape, and of a beautiful consistency to work with.

The snow blocks when first laid do not fit closely. Wedge-shaped blocks are gently forced into the larger apertures, and the smaller ones are filled with soft snow gently rubbed in—not patted. When the joints thus filled solidify, they become stronger than the original blocks, and after a period of settling, the entire structure becomes very solid.

When a snowhouse is to be used for some time, it is "iced." This is accomplished by closing the door and raising the temperature by artificial heat. When the walls, which absorb moisture like blotting paper, become spongy, the door block is removed and a ventilation hole is made in the roof. As the hot air rushes upward, cold air enters the door and in a few minutes the walls are coated with a film of ice, making it wind-proof and strong.

If you have any sort of a fire in a snowhouse, just as in any tightly built house, it is necessary to have a ventilation hole or else open the door every now and then; otherwise carbon monoxide may accumulate and cause asphyxiation. The presence of this gas is indetectable, and its effect is sudden, so do not wait until you think you notice the effects.

Another type of snow shelter is the snow cave. As its name implies, it is a shelter shoveled out of deep snow. As developed by the Arctic Training School, its interior is identical with that of the snowhouse, with a domed roof, a raised sleeping platform, and a low door. During the war large numbers of men were taught to build these shelters and lived in them comfortably on the snow and glacier slopes of our high mountains. The side walls of crevasses proved to be excellent sites for snow caves.

A comparison of the two types of snow shelters, by actual use, reveals the following differences:

1. The snow cave, while it requires less skill to make, entails more physical labor. In addition, the work is "sloppier," because digging out a chamber in deep snow results in the worker getting wet from the snow that covers his clothing.

2. Only one man can work in the early stages of snow-cave building, whereas any number of men can cut snow blocks for a snowhouse.

3. The snow cave is darker. The comparatively thin blocks of a snowhouse admit a strong diffused light. Stefansson states that in periods of bright sunshine men have even become snow-blind while inside of snowhouses.

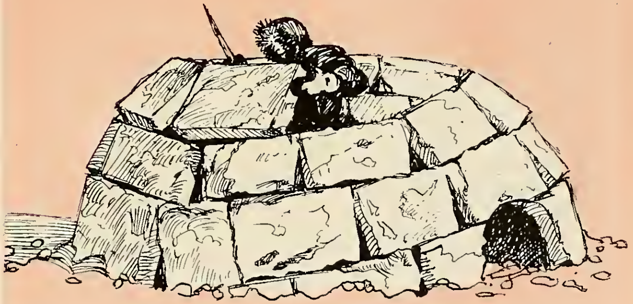
4. Unless the roof of a snow cave is generously thick, it may collapse, whereas the domed roof of a snowhouse will bear a heavy weight after the house has been "iced." Sir Hubert Wilkins told the writer of an occasion when his snow roof was tested in a manner that, while convincing, will never become popular. While he and his companions were inside, a polar bear climbed over the roof!

Let us now consider the practicability of the snowhouse for use by outdoor men in our snow areas. Its extreme importance in any form of northern warfare is beyond dispute. If, in any military unit, be it a company or a regiment, one out of every four men is a trained snowhouse-builder, the entire unit can be snugly housed from the most savage cold or wind in about 45 minutes. In addition, a scattered group of snowhouses is less conspicuous than any other type of military camp.

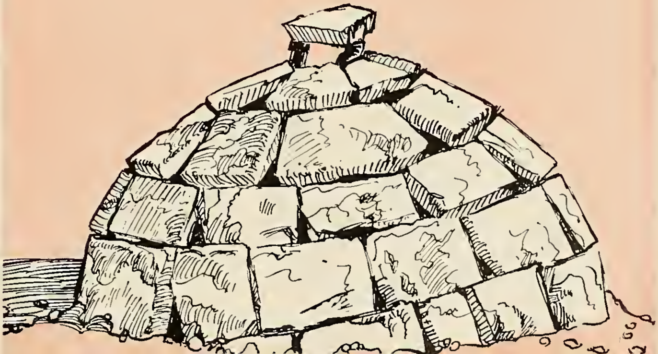
Experienced mountaineers are universally outspoken in their praise both of the snowhouse and snow cave for use in high altitude climbing. However, one does not have to go to the far-off places to

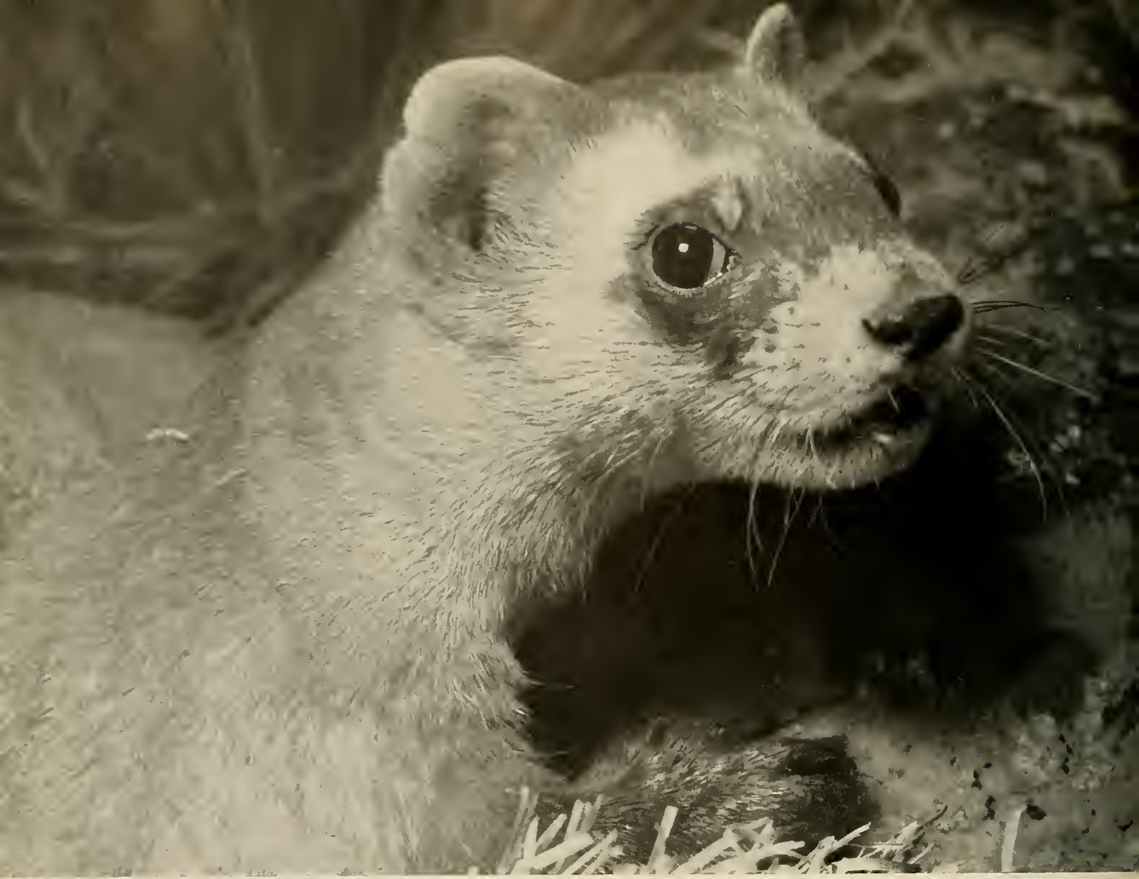
Continued on page 486

Nearly finished. The door through which the blocks are passed is shown at right



Fitting the king block. The temporary door has been closed, and when the main entrance is shoveled out the house will be completed





Black-Footed FERRET

BY WALKER VAN RIPER *and* ROBERT J. NIEDRACH

Colorado Museum of Natural History, Denver, Colorado

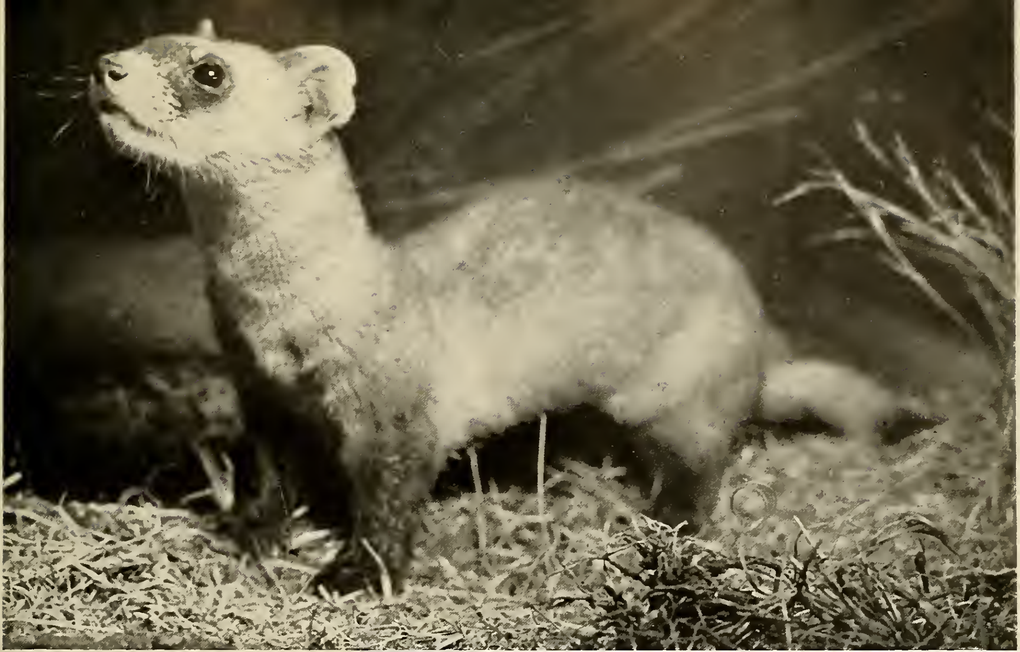
THE black-footed ferret, (*Mustela nigripes*), pictured here by means of the high-speed flash, is a rather uncommon animal found from western North Dakota and Montana south to Texas. It is seen most often around prairie dog towns, where it preys on the inhabitants.

The black-footed ferret has the distinction of having been lost to science for many years. It was first described by Audubon and Bachman in 1851, after which no more specimens were reported by naturalists until around the turn of the century.

Unlike some of its near relatives the weasels, which sometimes play havoc in the poultry yard, killing for the mere love of killing, this animal should be regarded as beneficial to man, as it helps to keep down prairie dog populations and seldom, if ever, comes around human habitations.

The animal is a light buff in color with a dark area in the middle of the back and on the tip of the tail. The feet are black, and there is a black mask across the eyes. It is the largest of the weasel-ferret group in the Rocky Mountain region. Mature males run a little over nineteen inches from tip to tip.

When teased a little, the ferret suddenly pops its head out of the burrow and emits a startling, chattering bark much like a Hallowe'en whirligig noisemaker. This one was trapped and placed in an artificial burrow in the laboratory for photographing. The pictures were made with the Edgerton high-speed flash, at 1/30,000 of a second and F/22.



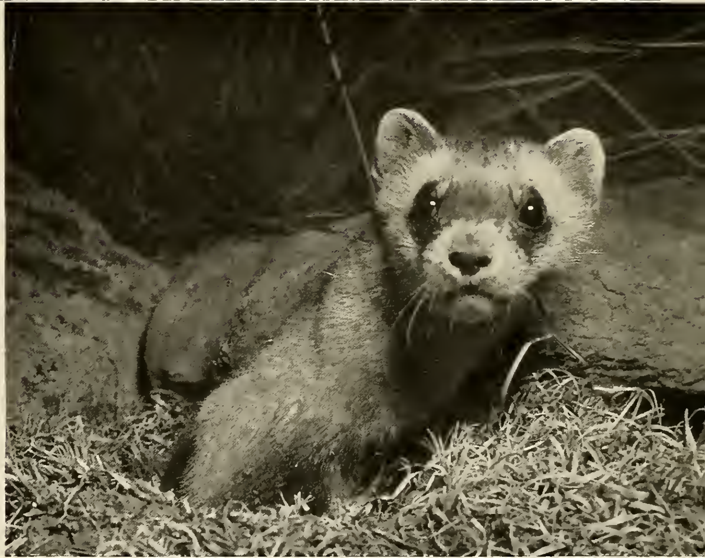
◀ PORTRAIT of a black-footed ferret

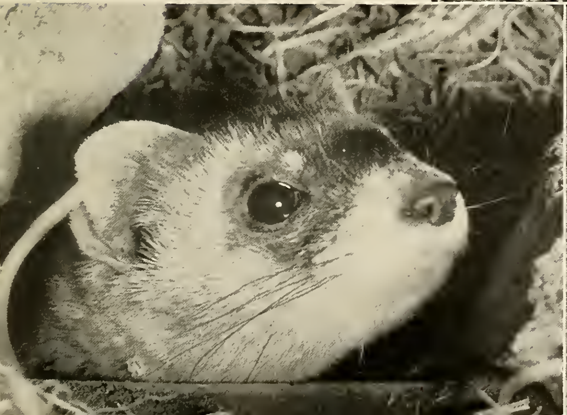
▲ UNUSED to man

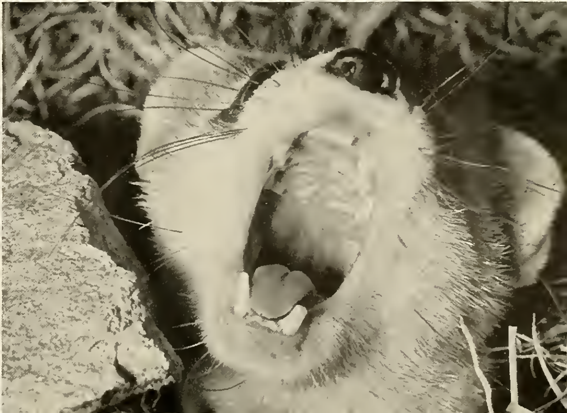
➤ CURIOSITY battling against caution

◀ VOICING its angry, chattering bark

▼ SLYLY INVESTIGATING







◄ DRAPED ABUNDANTLY from cypress trees, Spanish moss, the trademark of our Southland, here frames a beautiful semi-tropical sunset

➤ LONG, GREY STREAMERS festoon trees and telephone lines, particularly in southern Florida

Vegetable Hair

By
HUGO H. SCHRODER
Photographs by the author

Spanish moss is neither Spanish nor moss, but it serves man with many uses and adds an exotic touch to our southern landscapes

WHEN the Florida-bound traveler passes through Virginia, his attention may be attracted to long, gray streamers hanging from the branches of trees and electric wires along the roadside. As he proceeds through the Carolinas and Georgia, this gray drapery becomes more abundant. In Florida it reaches its peak. It not only flourishes in the cypress swamps but on lone trees of various kinds throughout the countryside, and even cities and towns have streets garlanded with the streamers.

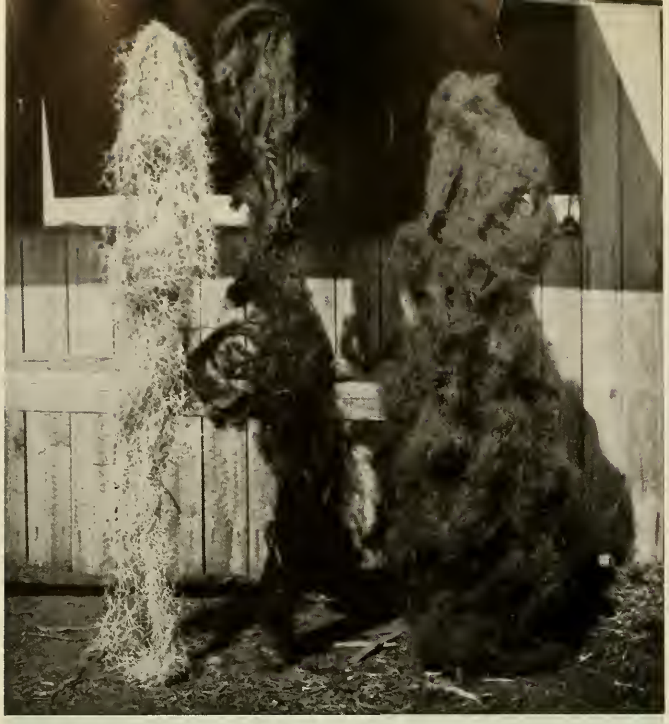
Spanish moss is an air plant, or epiphyte. It is related to the pineapple, though it would be difficult to find two plants that, on first sight, look more different. Most of Florida's dozen or so other plants belonging to the genus *Tillandsia*, however, show the relationship more plainly. Some of them when viewed from a distance look like large birds' nests; others are small. Spanish moss extends abundantly into the American tropics.

Ordinarily the streamers of Spanish moss are from one to eight feet long, so it is sometimes called long moss. If the twisting strands were straightened, they would be nearly doubled in length. Often a number of the plants grow so close together that they form a dense cluster that is almost impossible to see through.

Actually these air plants take no nourishment from the tree. Unlike mistletoe, which derives part of its nourishment from its host, Spanish moss asks only an anchoring place. It makes all of its food from carbon dioxide, drawn from the air, from water derived from rain or other atmospheric moisture, and from dust or other particles. It is possible for a dense growth of Spanish moss to smother the twigs and leaves where it is hanging, but ordinarily it seems to do little or no damage.

During dry weather, the plant is a dull, lifeless gray. When a shower descends, the hungry moss drinks up the moisture and quickly changes to a much greener hue. But the next day it returns to its usual monotonous gray.

In the spring, a tiny, greenish three-petaled flower appears, which is so inconspicuous that few people notice it. The flowering season extends over a considerable period.



▲ **Three stages of Spanish moss processing** *(left to right)*: green moss as it arrives, matted strands after exposure, and the finished product after ginning

When the seeds ripen, the slender ~~seed~~ pods split open and discharge their feathery contents into the air. The seeds are very light and are provided with silky "parachutes," so they float through the air and perchance make a landing on the bark of some tree, there to start new growth. If the winds carry the seeds against an insulated power line, they attach themselves to worn places in the insulation just as readily as they would to the rough bark of a tree. Thus we find streamers of Spanish moss growing from electric wires—a sight which, particularly in southern Florida, surprises the traveler on his first visit. One of the small Tillandsias likewise finds power lines suitable, and both plants may often be seen together. They seem to grow there just as readily as on the bark of trees, proving that they do not need a living host.

Long before the era of man, birds and animals made use of Spanish moss. It provided a handy material for home building or to screen their nests from the eyes of enemies. Parula warblers often nest in a dense moss cluster, where they are almost invisible unless one notices the bird leaving or returning. Hawks and various other birds sometimes use strands of the moss for nest-building or build their homes behind a screen of sheltering moss. Other animals find a shelter from rain and cold winds among the dense moss clusters.

Spanish moss used to be known chiefly for the picturesque touch it added to the southern landscape; today it is a valuable crop, used for a variety of purposes. Hunters and other outdoor men, when camping in the wilds, find that a thick covering of Spanish moss under their tent floor, or under their blankets, provides a dryer and more comfortable sleeping place. A wad of the moss plus some sand makes a useful pad for scouring pots and pans.

▲ **Soaking the moss** at a moss yard, where it will be left to weather for 60 days so that the outer covering will decay

I have seen Spanish moss used to protect furniture in transit under a wrapping of gunny sack. It is also used for screening plants from the sun. Strands of moss are draped from wires or slats, and the degree of shade can easily be regulated. For a screen around plant sheds, strands of moss are pulled through the meshes of chicken wire fencing. Where trees or shrubbery are lacking, poultrymen drape long strands of the "vegetable hair" over their fencing to give the fowls shade.

A small animal hospital used moss to shade its outdoor dog runs. A shuffleboard court in a Florida community used it over a framework of iron pipes to provide a roof above the seats at the ends of the courts. Urban residents have used moss festoons hung over wire

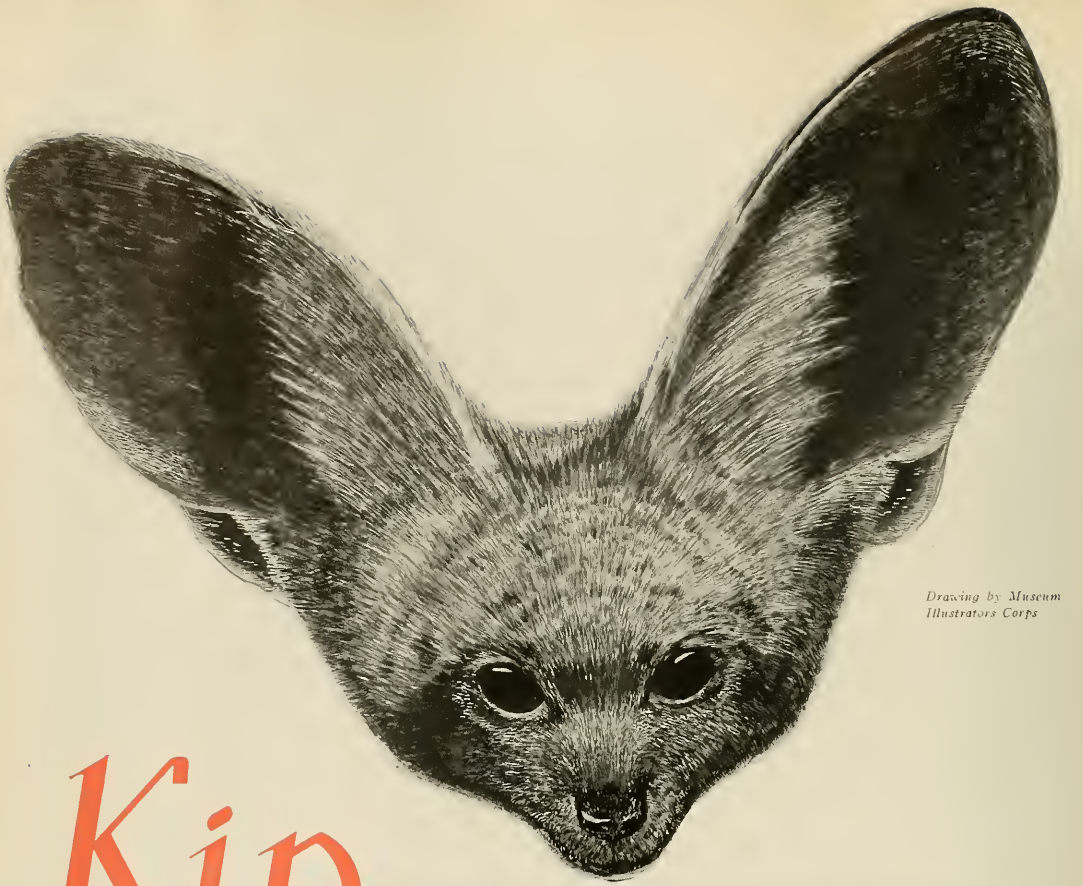
fences to provide greater privacy. It also came to the rescue when cloth awnings were out during depression days. But indoors it should be used guardedly, because of the fire hazard.

After the green Spanish moss arrives at the moss yard, it is spread over the ground to a depth of about five or six feet. The next step is to thoroughly wet the entire mass. It is then left to cure for a period of 60 days or longer. During this time the outer covering of the plant rots, leaving the entire mass a dark brown color.

After proper curing, the strands are hung over wires to dry in the sun and wind before they are ginned to remove the rotted material covering the inner fiber. One of the Florida moss gins I visited sorted the dried moss into six different grades before ginning. Furniture manufacturers use the inner fiber for filling upholstered furniture and "hair mattresses." In the past, many automobile seat cushions were filled with it.

Spanish moss is economically important to a good many people in the South, because it provides a crop when other products are out of season or under par. Spanish moss does not have to be planted or cared for; Mother Nature provides for it. As the State Forester of Louisiana put it, "To the tourist, Spanish moss has esthetic value and is appreciated for the weird and mysterious aspect it gives to our swamps and hardwood regions; but to the citizen of Louisiana, Spanish moss is a veritable gold mine of the air. It is a savings bank, and always at hand to gather whenever he needs funds." The wind distributes its seeds, and birds help to carry moss to new trees at nesting time. It requires no cultivation or fertilizing, and no spraying to keep insects from devouring it. In fact, those who gather "vegetable hair" say that "money does grow on trees."

➤WEATHERED MOSS being spread over wires for drying before ginning. The finished product will serve as upholstering and packing material



Drawing by Museum Illustrators Corps

Kip

AN INTERESTING AND UNUSUAL PET OF EAST AFRICA

By Arthur Loveridge

Curator of Reptiles and Amphibians at Harvard's Museum of Comparative Zoölogy

THE bat-eared or great-eared foxes of East Africa are so unlike ordinary foxes that few people recognize the relationship. More often the adults are mistakenly supposed to be the young of jackals or hunting-dogs. Back in 1864 this error even crept into a scientific publication when a communication from that able botanist, Sir John Kirk, stated that bat-eared foxes hunt in packs and, though inferior in speed to the antelope, run buck down by wearing them out. At times, continued the article, they may even kill a buffalo. This ludicrous libel on a timid animal the size of a fox terrier, is clearly due to someone's having confused the bat-eared fox with the better-known hunting-dog. The fox's scientific name is *Otocyon megalotis virgatus*.

It was a native of Tanganyika Territory who brought me the first I ever saw. The fox had been killed by his dog, and with it were two charming little cubs. At that tender age they were an almost uniform smoky-gray color, with but a faint indication of the handsome black marking that would later adorn the tail. Their eyes were open and they were just able to stumble about.

As the cubs were to share my tent for the next month, I arranged cozy quarters for them in a box from which they could not wander. During the first few weeks they saw to it that I rose once or twice each night to give them their bottle, for when hungry they announced the fact with sibilant whistling calls. At all times they could produce a large and varied repertoire of noises to scare unwelcome visitors. Except for a couple of hours at noon, when they took a siesta, the cubs were lively all day. This was apparently normal, for at Saranda I had been shown a burrow around which eight foxes had been seen basking one sunny morning. Cubs that are lively by day and sleepy at night probably suit parents who have to go out foraging at night. Later my cubs liked to be out after dark, particularly in bright moonlight, but if shut in a room they would go to their box, settle down, and sleep till morning.

A month after I got them, to my

great regret, one of the cubs suddenly died. It was then about six weeks old and measured sixteen inches from nose to tail-tip.

By the time the survivor was six months old he had lost all traces of cubhood and rather resembled a perky little Pomeranian, though with shorter hair. But he bore a thick, woolly, buff-colored under-fur, for cold winds sometimes sweep across his upland home at night. This under-fur was almost concealed by long, black-tipped, whitish hairs, so that the general hue was a grizzled gray. However, the black of the muzzle extended on to the forehead between the eyes and still farther back on the cheeks. The tips of the large ears were likewise black but their edges were fringed with pure white hairs, and there was much buff about the base of each. The legs were darker than the body; indeed, from the knees down they were black. Black, too, was the tip of the bushy tail, as well as a wedge-shaped patch on its upperside that reached almost to the root. At this time the cub might be considered grown-up, for he was only two inches shorter than his 30-inch father.

I called him Kip, short for *kipara*, the Chagga name for a bat-eared fox. Had I known at the time the word was *bili* in Ramba, *bii* in Nyaturu, and *nchenjeji* in Gogo, I should probably have called him *bili* (pronounced *beelee*), as he came from near Ramba territory. When past the milk stage Kip was given a good deal of finely chopped meat. At three weeks old he took a green grasshopper. Shortly afterwards he pounced on a striped hawk moth, chewed it well, dropped it, and then gobbled it up. He was passionately fond of butter and honey, and would also eat porridge, bread, and eggs. He drank milk or tea with relish. Bananas and papaya were also eaten readily, but he would not touch mangoes or pineapple. Not all bat-eared foxes share Kip's tastes, for two that were brought to me as adults refused to touch papaya or sweetened cereals. Milk, or bread-and-milk, they took in moderation, but rarely finished hard-boiled eggs if minced with meat. In fact, finely minced raw meat *alone* was about the only food they never refused.

As he grew older Kip was free to wander all day and spent much of his leisure turning stones in search of millipedes, which he ate avidly. I often tossed him one. He would run to the spot where it fell, pause for a second as if to make sure it was edible, then devour it. Once I offered him a black-and-yellow relative of the millipedes known as a polydesmid. For three minutes he pawed it over and over but would not eat the acrid creature. This was in strange contrast with his attitude toward a stink ant (*Paltothyreus tarsatus*) which came out of a hole waving its antennae right under Kip's nose. He looked at the insect, then seized and crunched it despite the foul smell, which was noticeable even where I was standing a couple of feet away. He would gobble up termites greedily, for "white ants" form the staple food of these foxes.

Cautious

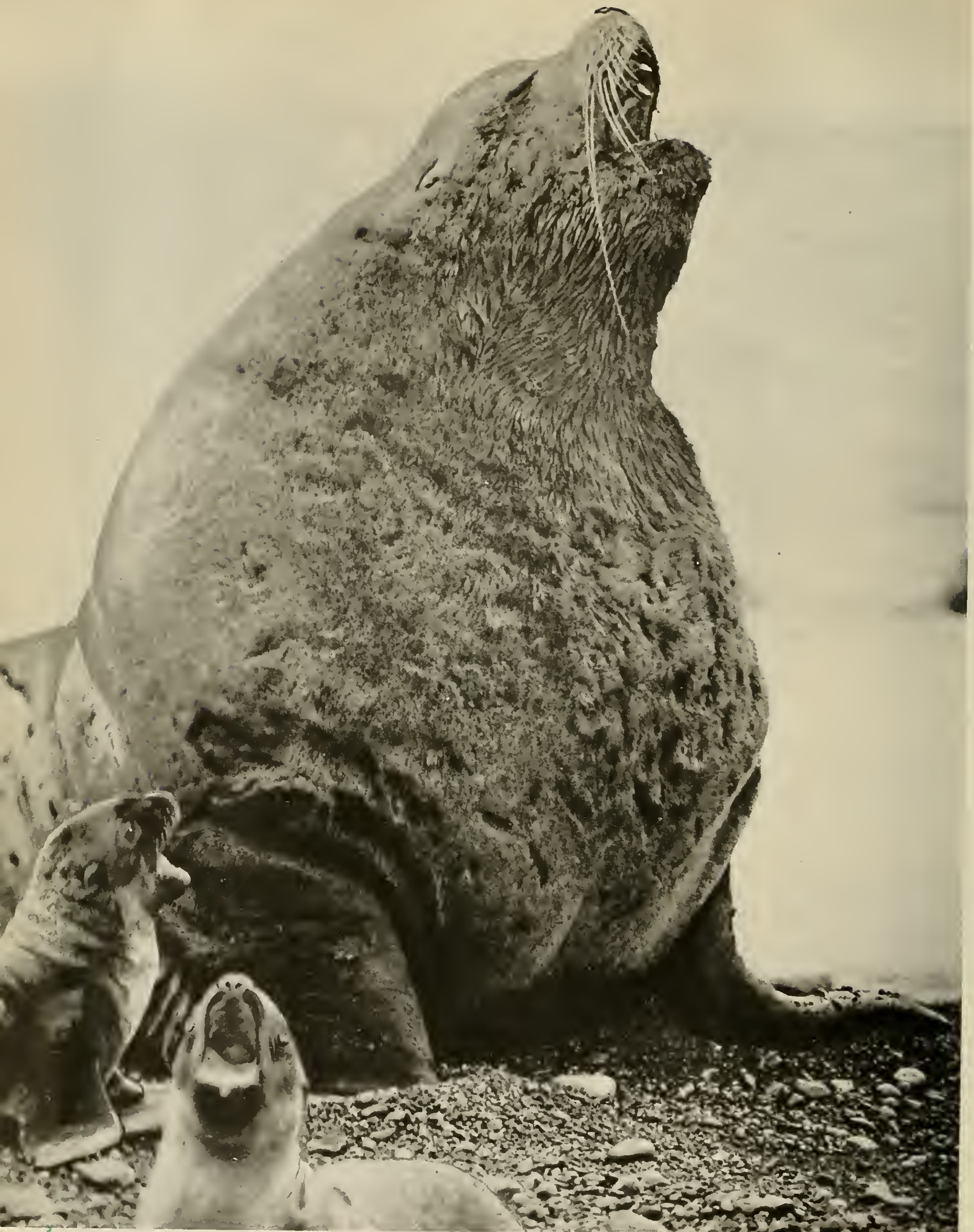
When he was feeding, Kip was always nervous of anyone approaching. Toward natives in particular he displayed a conspicuous antipathy that was difficult to understand, for all my boys were fond of him. Probably this was an inherent trait shared by monkeys and some other African animals. At four months old he took to menacing the boys, snarling, growling, and looking very wicked, with bared teeth. His bites were harmless, even when he was furiously annoyed at being caught and carried in for the night. His feeble teeth, designed for crunching insects, drew blood only when they nipped a knuckle or some other thin-skinned spot. If Kip were chased, he would zigzag this way and that with the greatest rapidity, his brush waving behind him in such a manner as to "cover his retreat" and render it difficult for a pursuing animal to seize him. Kip himself enjoyed chasing fowls. He would canter after them with his brush arched, and though he never attempted to bite any of the clucking birds, he would run beside them snapping his jaws loudly.

In view of his natural timidity, Kip's behavior toward baboons was strange—as was their tolerance of him, for baboons are alleged to kill dogs. The first time I witnessed a meeting was one sultry afternoon when the boys were either asleep or away, so there was no one about. A very big baboon, sneaking up to the kitchen door, aroused Kip's curiosity. With head held down, the little fox followed the ape until the latter caught sight of him and cantered away. For 200 yards Kip flew after the big beast, with only about six feet between them. A month later baboons were daily in the vicinity of the house, and on several occasions I saw Kip playing with them. The fox lay crouched upon the driveway until a big dog-baboon, walking slowly toward him, would come within a couple of yards; then Kip would spring up and rush straight at the larger animal. The baboon, loping easily away, would look back over his shoulder at the pursuer he could so easily kill. Many other baboons would be close by, either watching the play or grubbing among the fallen leaves and branches in the vicinity.

At the age of six-and-a-half months Kip met his first dog, a quiet little mongrel dachshund accompanying a visitor. Growling and bristling, Kip advanced toward the stranger, and for the first time we saw a large rufous patch of fur that had hitherto been concealed among the long black hairs of his tail. That was all that happened, but the dachshund's owner, who was very fond of dogs, offered to care for Kip any time I should be off on a long safari.

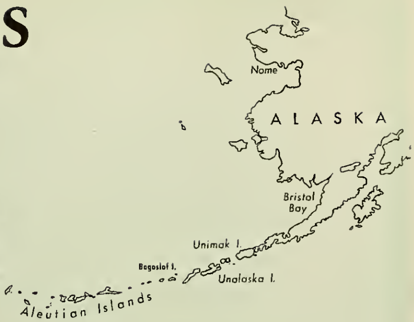
So some months later Kip did go to the farm—a week's journey. He rode in state in a basket poised on an African's head, with one of my boys as chaperon. It was a relief to receive word that "Louis and Kip arrived safe and sound yesterday and we adore Kip. He has the run of the house, but until he is used to the dogs I do not want to let him out. He is an ideal pet,

Continued on page 490



▲ A GIANT BULL, his chest scarred from harem battles with countless rivals, roars full-throated defiance at the camera

The Sea Lions
OF BOGOSLOF



A visit to the "Disappearing Isle" of Bering Sea, whose
beaches are the summer home of the largest breed-
ing colony of Steller's sea lions in American waters

By Ben East

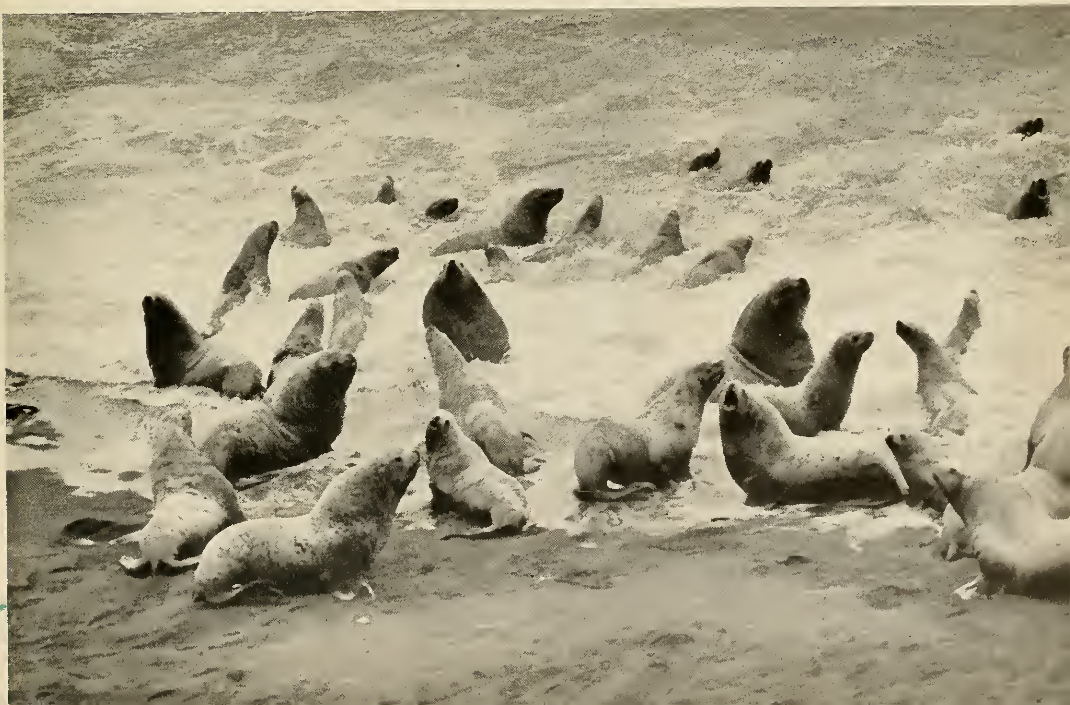
All photographs by the author

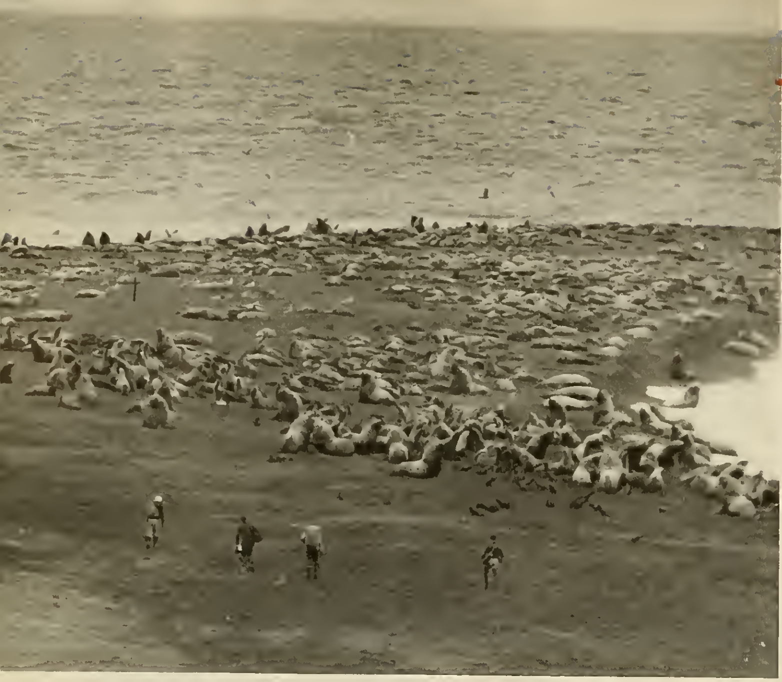
BOGOSLOF is a queer island. Even in a chain of islands as strange and starkly beautiful as the fog-shrouded, treeless Aleutians, it stands out. It is a solitary, temperamental, explosive speck of land rising from the wide and empty reaches of Bering Sea. It was born only a minute ago in earth time, within the last two centuries, and is the smoking, steaming crest of a young volcano building on the ocean floor. It erupted so often in its infancy, popping up, sinking down, changing shape, sometimes forming two islets, sometimes one, sometimes almost none at all, that the Russians called it the Disappearing Isle. They never found it twice alike.

It is hardly more than a mile long, perhaps a quarter as wide. It lies in the open sea less than 50 miles north of Umnak, in the Aleutian chain, a little farther northwest of Dutch Harbor.

Its beaches are of black volcanic sand, sterile and dead. Its cliffs rise sheer and forbidding from the sea. It stands by itself, a tiny outpost of land, swept by endless winds, pounded by endless surf, treeless and barren and alone. And, as if its jutting headlands and jagged pinnacles were not sufficient reminders of the subterranean fires that forged it and still smolder beneath its thin crust, a pillar of steam rises from a boiling basin as

▼ BIG BULLS, driven from their harem grounds to the sea, pause at the water's edge to protest in bellowing roars





◄ STELLER SEA LIONS in the crowded breeding colony on Bogoslof Island give way before the camerman, bawling defiance as they retreat. Note the size of the animals in comparison with the men

▼ THE STELLER SEA LION is a mammal of strong instincts and low intelligence, but the pups, for all their moronic looks, are appealing little fellows

big as an average duck pond, just above the beach.

Yet Bogoslof—queer, restless island of hot springs and cold surf—is far from the lifeless spot you might expect it to be. Its cliffs harbor sea birds by the thousands, murres that nest in close-packed, crowded ranks on the tiny ledges, puffins that stand on the headlands hour after hour, as solemn as feathered judges, staring motionless out over the sea. A sloping meadow of sparse grass, on a plateau a hundred feet above the beach, is turned into a busy bird city by hundreds of glaucous gulls that regularly raid the murre ledges for eggs. And from spring to summer each year the beaches are the home of the largest breeding colony of Steller's sea lions found in American waters, probably the biggest single colony left on earth.

Above all, it is the sea lions that make the island a strange place.

You come in off the sea to Bogoslof in a small ship, feeling your way over the shoals on the lee side, for there is no harbor and no safe anchorage. You lie-to perhaps a half mile off shore, and the sights and sounds of the sea lion colony assail you together.

Ranged along the black sand beach just above the line of silver where the surf is breaking, sea lion bulls, upreared on their front flippers, form an unbroken rank, spaced only a few yards apart. Huge, yellow-brown brutes, they look like sentries guarding the lonely island. Behind them, scattered over the rock-strewn beach as far as you can see, are scores and hundreds more of the colony, cows and bulls together, and clusters of darker, brownish pups scarcely visible on the dark sand. Some are upreared like the bulls at the water's edge, some are sprawled out at full length as if asleep. A few are shuffling around, ponderous and deliberate, creating a scene in slow motion.

And coming out over the water, rising and falling in irregular rhythm, there beats a bawling, bellowing roar, incessant as the sound of surf, but with a wild quality unlike any noise you have ever heard on a beach. It is the voice of the great herd, bulls and cows and pups barking and roaring and bleating. The unending summer conversation of the sea lion colony breaks from perhaps 5000 animal throats in chaotic unison. It speaks of their loves, their battles, their parenthood, their resentment at your intrusion. It is a sound you will never forget.

If you plan to go ashore to study or to photograph, you will probably worry about how you can make a stealthy landing. How can you gain the beach in the pounding surf, how shall you put your dory in, without alarming the sea lions and driving the whole colony into the sea?

You can rest easy on that score. There is hardly a sea lion in the herd that fears you, that has any thought of retreating from you, that will move from his usual place if you seek to land. The bulls along the water will stand their ground. Of that you may be sure. And behind them the cows and pups will watch you warily, but without panic. As a matter of fact, you may even have difficulty in establishing a beachhead at all.

The surf will give you trouble

enough, unless the day is unusually fine for those waters. You will approach cautiously, shouting and doing your best to breach the line of sentry bulls. Don't force the issue. A half-dozen men are no match for a bull sea lion in hand-to-hand combat; and while you are landing, the odds are all on his side. Break the courage of one or two bulls first, bluff them off, drive them back before you make the run in through the surf.

Once ashore you can move near to, or through, the herd with safety if you are careful. They respect you on land and will give way to you. Now and then you will meet a bull, mounting guard over his chosen harem site, who will stand his ground. Take no chances with him. He is slow and lumbering, but his mood may be that of an enraged bear, and he can harm you dangerously if he succeeds in closing with you. Circle around him and seek out another family with a guardian less steadfast.

However long you stay ashore you will have an interesting time. The Steller's sea lion was named after the scientist who accompanied Vitus Bering to this region two centuries ago, and he is one of the most dramatic of the marine animals of the north Pacific. He is a pinniped, a "feather-foot," belonging to the family that also claims the fur seal, the California sea lion, and the walrus. Among these, he ranks only below the walrus in size. His smallest kinsman is the fur seal. Second comes the better-known sea lion of the California coast—whose cows you may have observed as the "trained seals" of circus or carnival—then the Steller himself. A Steller's sea lion bull in prime condition may weigh more than a ton. The average weight commonly listed by authorities is about 1400 pounds, but the Chicago Natural History Museum has a record of one that exceeded 2200. But big as he is, this sea lion of the north reaches hardly more than half the weight of the walrus, king of the family.

With all the members of the group the males are far larger than the females. The Steller cow weighs only from 400 to 600 pounds, and her lord and master rules her with an iron hand, as might be expected where the odds of power are stacked so heavily on the masculine side.

The sea lions come in from the sea in early summer to breed and to bear and suckle the awkward, stupid-looking brown pups. Theirs is a society based on polygamy, almost as spectacular as that of the Alaskan fur seals. The harems of the sea lion are smaller, however, and harem discipline is less strict among the sea lions. In fact, the whole organization of the crowded colony appears to be more loosely knit, perhaps not quite so efficient as that of the seals.

One advantage the sea lions possess over the seals is their coat of coarse, yellow-brown hair, without the silken underfur that has kept a blood price on the seal's head for more than 200 years. Since they were without value in the market, the sea lions partially escaped the slaughter that reduced the seal herds to the threshold of extinction 40 years ago.

In primitive times the Steller's sea lion was the staff of life for the Aleut native, taking much the same place in his economy and culture as the walrus still plays among the Eskimos farther north. His pelt supplied a mat for the floor of the Aleut bara bara, a covering for the skin boats (baidar and baidarka) in which the natives cruised these waters. The intestines furnished raincoats, the sinews thread, the blubber oil for lighting and heating. The Aleuts hunted sea lions for food and clothing and many other needs, and even 50 years ago the drives on the Pribilof Islands were bloody spectacles. But in modern times the sea lion has no commercial worth and so has gone largely unpersecuted. Had he worn fur, it is hardly likely he would have fared better than the sea otter or as well as the fur seal. Indeed, in that case the Bogoslof beaches probably would have been empty long ago.

As it is, Bogoslof is part of the Aleutian Island Refuge patrolled by the United States Fish and Wildlife Service. The sea lions are protected on their breeding grounds, and there is every reason to believe the big herd will continue to assemble there as long as the strange island does not blow up beneath them and sink into the sea.

▲ Sea lion pups, too young to take to the sea, are left deserted on the beach when the older animals are driven off. Their strong gregarious instinct impels them to huddle together in a tight cluster. As with the fur seals, a group of this size is called a pod

◂A MOUNTAIN RAM in his native range, the Rockies of Alberta

Can Anima

Retrace the Northwest trails with a veteran guide who has lived all his life with game, big and small,—and draw your own conclusions

SHOWING clear and sharp against a background of craggy, snow-covered peaks, the big bull elk made a fine picture in the field of my binoculars, as he lay bedded deep in the snow on the slope of an alpine meadow at timberline. Although the sun was shining, it was a snappy ten below. Hunkered down in the lee of a wind-blown pine, I watched through my glasses, shivering in the biting wind. Up on the meadow, a thousand yards away, the big bull seemed comfortable enough, well insulated by his heavy coat of hollow hair.

Through my twelve-power Zeiss glasses, I could see every detail as he lay peacefully chewing his cud. When he tipped his head a little, all twelve points of his mighty antlers were cleanly outlined against the white slope.

After half an hour had passed, he stood up in his bed, looking down over the country below as though trying to decide where he would go for his afternoon feed. Apparently he saw nothing more attractive than the meadow where he stood, for, stepping out of his bed, he began pawing down through fourteen inches of snow for the tasty bunch grass beneath.

After watching him feed for 50 yards along the meadow, I caught a flash of movement on the edge of a stunted clump of balsams 200 yards farther up the mountain beyond. A second later a big gray coyote stepped into view. After looking down the slope for a minute at the elk, the brush wolf trotted down into the meadow in a business-like way. There he poked through the tufts of grass sticking up out of the elk's tracks, looking for mice. Although I watched him carefully, I did not see him catch a mouse. Slowly he investigated each of the pawed-out places, until he came up within a few yards of the bull's rear. There he stood for a few moments sizing up the situation. Obviously his technique was wrong. Apparently deciding to change his tactics, he trotted casually around the bull, until he was directly in front of the big animal. Stopping again, he looked up into the elk's face from a range of only a few feet.

If the old bull saw him, he did not show it. To say he ignored the saucy coyote would be an understatement. He was the royal rajah suddenly confronted by one of the untouchables. He didn't look at the little wolf—he looked right through him, and went on feeding as though he didn't exist. As for the coyote, he seemed to think this lack of recognition was just what he wanted. After a moment or two of close study, he dodged around to one side of the bull and stood practically in his shadow. The elk still ignored him, so he moved

Think?

➤ "This fine elk used his ears and eyes to spot us through a screen of boughs"

F. H. Riggall photos

By

Andrew G. A. Russell

even closer. Then as the bull lifted a forefoot to paw away the snow from the grass, the coyote stood poised to pounce on any mouse that might be kicked out of his cover. Almost unable to believe what I saw, I watched that smart little wolf use the proud old bull for a sort of unsuspecting mouse digger for the better part of half an hour. Several times I saw him duck right under the elk's belly and snatch a mouse from under his feet. Finally the old bull lay down again, and the coyote went happily on his way, much benefited by the use of his smart, well-developed brain.

There are people who explain the many curious actions of animals by the use of one word—instinct. To my way of thinking, the word instinct covers a very small part of animal behavior. Anyone who doubts this need only go afield with a pair of good binoculars, and all the patience he has. To see wild game meet the everyday emergencies of their lives and solve the ever-changing problems of their existence is the surest way to be convinced that animals use more than instinct to stay alive.

Different species of animals have highly developed senses to suit their particular needs. Some have finely developed eyes, others depend upon their ears, while a well-developed nose is the outstanding organ of protection used by many. The Indian has a way of explaining this.

He says, "A needle fell from the pine in the forest. The bear smelled it as it fell. The deer heard it. The eagle saw it fall."

In the Rockies of the far West we could exchange the mountain sheep for the eagle in that quotation, for the sheep has marvelously keen eyes.

In addition to highly developed organs of sound, sight, and smell, or combinations of the three, most animals have a well-developed brain. Furthermore they can use that brain to good advantage.

A number of years ago, a small colony of beaver established themselves on our ranch. At first there was only one pair in a small dam on the headwaters of the creek that wanders down through a muskeg before coming out on some flats, where our hay meadows are located. Under careful protection, the beavers increased and spread out, until their dams were actually flooding a good part of our meadows. Then they energetically began to build a dam that threatened to flood a bridge crossing the creek, and we began to realize that something would have to be done.

Optimistically we pulled out the offending dam in hope of scaring the beavers into another part of the creek. It wasn't as easy as that, for in a couple of days the dam was as good as ever. Then began a contest to see who was the most stubborn—we or the beavers. Every night after work we pulled out the dam. Every morning it would be as good as new. We tried scarecrows. They worked for one night. The next night the beavers ignored them, and built up the dam. It soon became quite plain we weren't getting anywhere, for the beavers got so tame that they often swam down to repair the breach, while we were in the act of making it. In spite of our failure, it was amusing to see a big beaver come paddling down stream with a huge mustache of weeds and mud sticking up from his face. If we were too close, he would slap the water indignantly with his broad tail and dive. But just as soon as we retreated a little, the dam would be once more under repair.

Finally when we were about ready to give up, our hired man had a brilliant idea. Taking a few old boards and nails he fashioned a water wheel with bright tin cans for paddles. Then tearing out the dam he placed the wheel on uprights, so that it would turn in the strong current. Then with an added touch of genius, he hung a huge cowbell on an overhanging limb, so that the paddles of the water wheel would clatter on it, as it revolved. We all rubbed our hands together with satisfaction. At last we had those persistent animals beaten.

The morning after the wheel was installed, everything was as it should be. The creek gushed through the breach in the dam merrily turning the wheel, which made an ungodly racket on the bell. We had visions of beavers scrambling madly upstream to get away from that devilish contraption down by the bridge. The second morning we investigated to find a surprising sight, which caused the hired man to swear mightily, and made us realize we were dealing with some very smart animals.

Although none of us was there to see what had happened in the night, the signs were plain to read. Sometime in the night a big beaver had come out on the bank upstream to think over this new threat to the peace and well-being of his colony. A few feet farther up the bank a six-foot chunk of half dry, peeled poplar pole lay where it it had been discarded the season before. The beaver went up to it, and in less time than it takes to tell it, rolled it over and pushed it down into the water. There the current picked it up and carried it downstream. In a few minutes it floated into the breach of the dam, jamming the wheel solidly, and like magic the silence of the night was restored. In a matter of minutes the whole colony was at work repairing the dam. When we arrived next morning the pond was brimming full again, and to add insult to injury, the cheeky beavers had used the water wheel for reinforcement.

Today we don't use that bridge any more. It is under about two feet of water. At the moment we have about 150 beaver dams on the ranch. As a matter of fact, there is some doubt as to who owns the ranch—we or the beavers.

To most of us the skunk is just a smallish black animal with white marks on his back, a touchy disposition, and armed with a gun that is always "loaded for bear," or anything else that threatens him. We don't particularly dislike him. We respect him. When we do think of him at all, it is with our noses wrinkled, and our thoughts may wander to prominent newspaper advertisements featuring pink soap. When threatened, he has the habit of "shooting first and asking questions afterwards," but aside from that we don't give him a great deal of credit for having much sense.

One fine April morning three years ago I had reason to revise my opinion. I was out riding, looking for strayed horses, when I spotted a skunk feeding away out in the middle of a hundred-acre flat. He wasn't much out of my way, so I rode over for a closer look. When I was still well out of range of his scent gun, he suddenly saw me and flagged his tail up in warning. Keeping at a discreet distance I stopped my horse, waiting to see what he would do. After a few minutes' hesitation he decided to move, making off at a shambling gallop for the nearest timber, a quarter of a mile away. Keeping back at a safe distance I followed. Then I rode off to one side trying to turn him away from the trees. To my surprise he responded perfectly, heading away at a new angle and apparently satisfied just to travel. After a little more experimenting I discovered I could drive him anywhere. If I had had a bucket, I am sure I could have corralled him in it. Just for fun I decided to try and drive him home—a distance of two miles.

Heading him across the big flat, I chased him toward a chain of meadows leading to the buildings. He drove better than most domestic animals, and we made good time for the first half-mile. But he was short-winded, and his gallop soon fell off to a shuffle. Then, while crossing from one meadow to another through a narrow strip of brush, he came close to a willow bush, and, seeing his chance, dove into it.

Stopping my horse I cautiously approached him on foot from the windward side. I had given up all hope of getting him home, but was curious to see what he would do if I stayed awhile. When he showed signs of uneasiness, I squatted on my heels and just watched. Facing me, he stamped his front feet threateningly a few times at first, but after a few minutes he settled down, and began to dig and eat the fresh green shoots of new grass growing at the base of the willow. Cautiously I moved closer. Several times he lifted his head, giving me a long look, and I could almost see the mental cogwheels turning through those bright black eyes. After considerable thought he seemed to decide that I meant no harm, for he allowed me to come up almost within reach. After a reasonable length of time, I care-

Continued on page 490

▲ ONE of The Twelve O'Clock Owls, which made the newspapers in a Trailside "Murder Story"

Owl Friends

Favorite pets at an outdoor nature museum helped to show the public that owls are greatly maligned and that they actually do more good than harm in maintaining the balance of nature

By WILLIAM H. CARR

Photographs by HAROLD K. WHITFORD

WE were once intimately acquainted with a number of owls for a long period of time. They occupied positions of honor at the Bear Mountain Trailside Museum on the shore of New York's Hudson River. Perhaps the individuals that will remain most vividly in our memories were the birds we knew as the "Twelve O'clock Owls." The pair came to us as infants, scarcely more than little bundles of white fluff. They were Barred Owls, and through the years they occupied a large cage near the office window of the museum headquarters. There is a special attraction about the sleek, roundheaded barred owl, and our birds were no exception. But from the beginning they were a target for the remarks of visitors who had misinformation to broadcast free of charge.

Along with the skunk, the toad, and other creatures in this particular category, owls have been maligned since people first devised ways and means of destroying them. In the Middle Ages they were credited with supernatural powers, and even today in certain parts of our own country they are shunned and feared because it is thought that their cry at night predicts the death of someone in the vicinity. The Bear Mountain owls, in a sense, served as ambassadors to inform human beings of the customs and habits of their kind. We placed a sign near the trailside cage that read, "Owls DO see in the daytime!" But this wasn't enough to convince a lot of the visitors. They would tell their children, "That's wrong, owls DO NOT see in the daytime! I know perfectly well they can't see!"

As our owls grew up and attained their beautiful gray plumage, they became a great attraction, sitting upon the perches all day long, with huge yellow eyes staring at those who paused to examine them. They would carefully watch the movements of dogs or other animals that chanced to wander by. In fact, they constantly demonstrated that they *could* see, and see well, too.

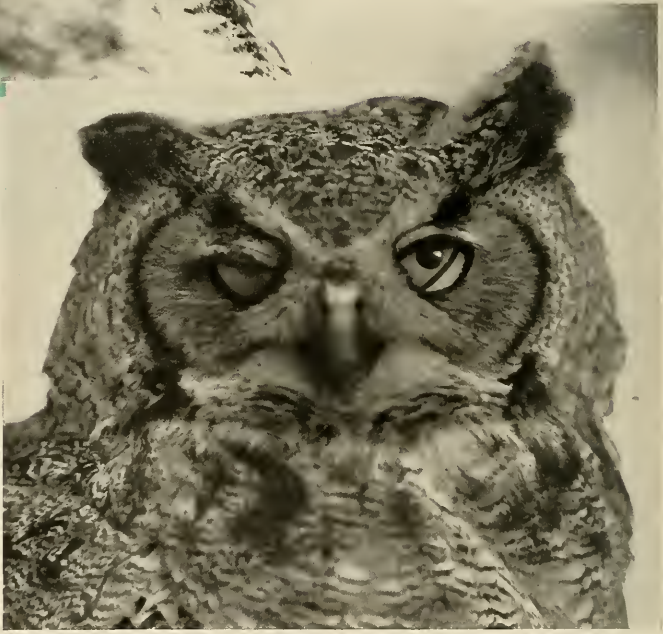
We called them the "Twelve O'clock Owls" because they would invariably "hoot" whenever the noon whistle sounded in the nearby town of Fort Montgomery. We

great horned owl

◀ The great horned owl is less docile than his Barred cousin and has been called the Tiger of the Air. But this one helped teach thousands of Park visitors that Great Horned Owls are useful in preserving the balance of nature

could actually set our watches by them. Sometimes we would fail to hear the whistle, perhaps because the wind was blowing in the wrong direction, but the owls would hear it and respond without fail. There were a number of skeptics who came back to Trailside several times to test our claims for them. However, after a few visits they were convinced. We never knew exactly what quality in the whistle prompted the birds to respond—perhaps something exciting in the timbre of the sound. Whatever it was, the birds answered back day after day, month after month.

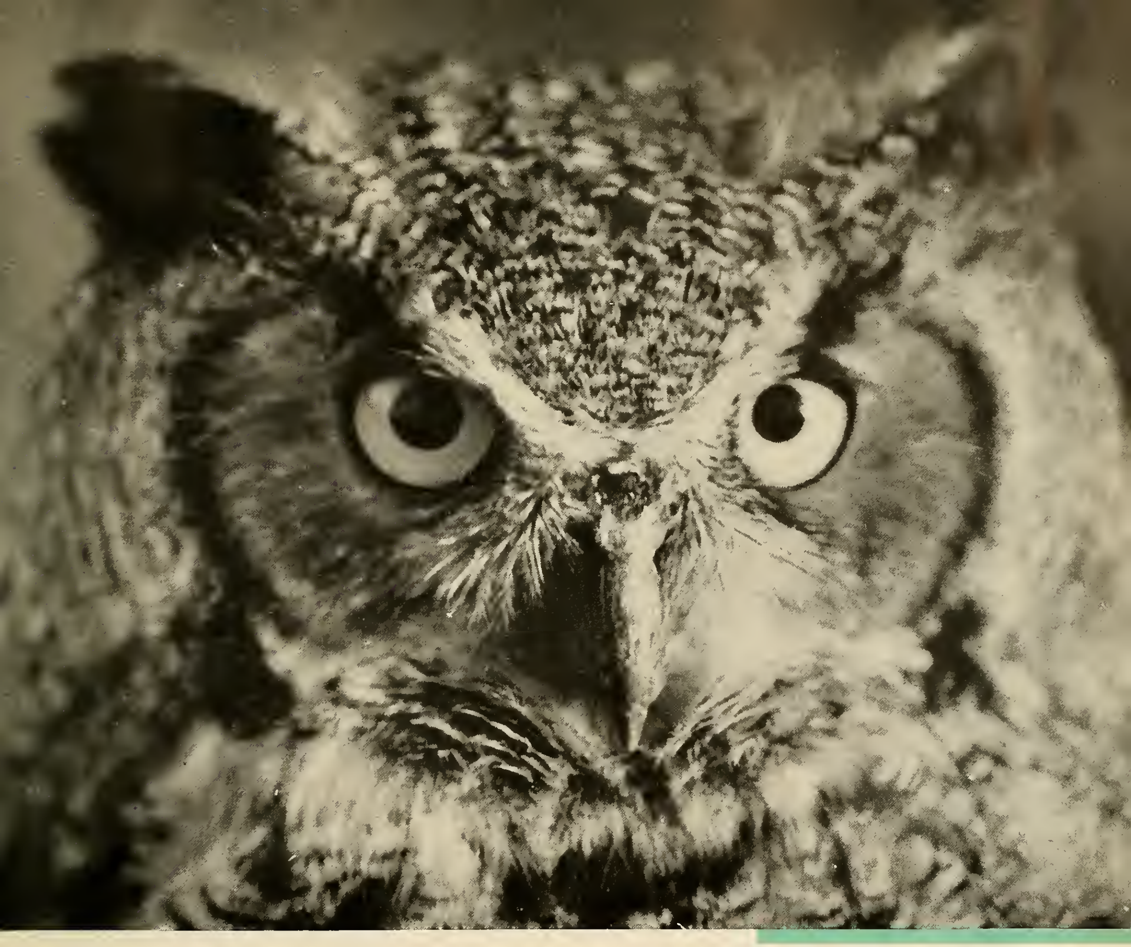
These birds received extensive publicity on one occasion, even being accorded a picture and considerable space upon the second page of the *New York Times*. It happened in this wise: Early one morning we left our cabin to start the day's work, only to discover that Joe, our likable and very well-known tame crow, lay dead upon the floor of his cage. We were saddened by the loss and were extremely curious to learn the cause of the death. Joe had been with us for seven years and had shown every sign of surviving for at least another seven. The previous day we had played with him, taking him upon our shoulders and walking about with him. He seemed in fine fettle and enjoyed his outing as usual. We simply could not understand what had happened.



▲ Caught in the act of blinking his eyes, this Great Horned Owl shows how the nictitating membrane serves as a sort of second eyelid

We entered the cage and took the poor creature in our hands. At first we could not discover a mark. In fact, we were still examining his feathers when one of the boys shouted, "Hey, look! The weasel is gone! He made a hole in one corner of his cage and got away. I'll bet he killed Joe!"

The weasel had a fair-sized cage to himself, not far from the crow enclosure. Sure enough, upon closer examination, we discovered that there were tiny tooth marks on Joe's neck. There was no question about it, the weasel had killed the bird. Just as we verified this fact, we chanced to look into the owls' cage adjacent. The two gray birds were resting upon their perches as usual, but one of them had something very interesting in one of his



▲ THE PUPIL of the eye narrows greatly in bright light. Here one is smaller than the other, because it was exposed to the full glare of the photographer's light. But, contrary to popular belief, owls *can* see in the daytime

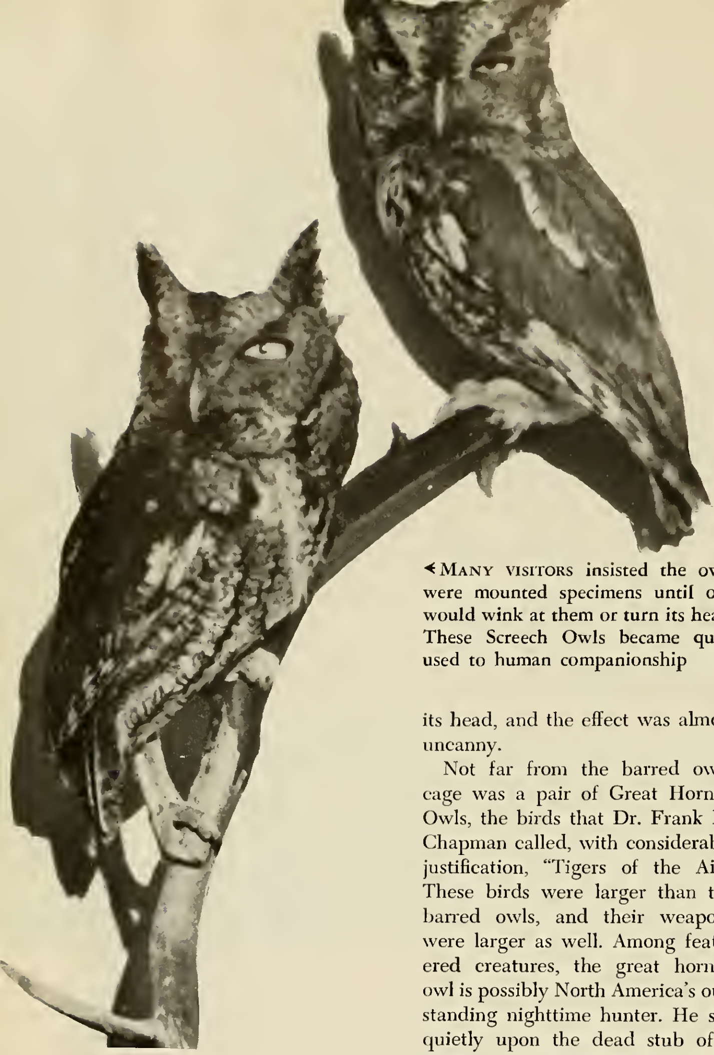
unrelenting talons. There, in fact, was the weasel, hanging down as limp as a rag and dead as the proverbial doornail. The weasel had made a fatal mistake. Upon finishing with poor Joe, he had entered the next cage only to meet swift retribution from above in the form of large, sharp, and powerful talons, which plunged through his neck and skull and held on until life was gone.

We all felt momentarily better about the affair, but on reflection, we realized that both creatures had only followed their own instincts and that we were really two-time losers—we had two cages to fill, instead of one.

The newspapers detected a perfect story of murder and revenge, and they made the best of it. We received letters from England and from other distant places expressing interest in the events. One woman in Brooklyn wrote to suggest that justice had been done but that we, the keepers of the birds and animals, were really the ones to blame, and she was absolutely correct. If we had built a better cage, the weasel would not have escaped in the first place and all would have been well!

This brought additional visitors to admire the two owls, and we heard some interesting remarks. As we stood near the cage one Sunday, a man with a little boy explained at length that these were indeed the birds that had become heroes overnight. Said he, "You know, owls always do things like that. I remember when I was a boy, whenever anyone did anything wrong, the old owls would come around the next night and get 'em, time after time. So, whenever you are a bad boy, look out! The owls will get you, sure as you're born!" Folklore is indeed the stuff of which dreams are made; nightmares too!

It was no wonder that the weasel had been caught napping. Owls possess the most marvelous ability to drop noiselessly upon their prey. The wing feathers are of such soft construction that scarcely the suggestion of a sound is heard as they sail downward. The unwary animal



screech owl

◄ **Many visitors insisted the owls were mounted specimens until one would wink at them or turn its head. These Screech Owls became quite used to human companionship**

that receives the initial thrust of those great claws often has no idea of what struck him until it is too late.

Many were the photographers who tried their luck with our owls, including Harold K. Whitford who made the portraits accompanying this article. He spent many a patient hour waiting for just the "right pose" and for the light to reflect from the large eyes to give the feeling of life he desired. Incidentally, it was no uncommon occurrence to have visitors stare at the birds and declare that they were mounted. "Why!" they would exclaim, "Those birds aren't alive!" Then one of the "Twelve O'clock Owls" would turn its head, and the effect was almost uncanny.

Not far from the barred owls' cage was a pair of Great Horned Owls, the birds that Dr. Frank M. Chapman called, with considerable justification, "Tigers of the Air." These birds were larger than the barred owls, and their weapons were larger as well. Among feathered creatures, the great horned owl is possibly North America's outstanding nighttime hunter. He sits quietly upon the dead stub of a tree as his eyes search the surroundings for some trace of motion that will give promise of a meal. Then, noiselessly, like his barred cousins, down he swoops. His beautiful, gray-brown and reddish body hurtles with precise aim through the shadows of the forest. In a flash some unfortunate woodland resident has breathed its last. Mice, rats, rabbits, and other animals fall before his attack.

Many citizens have been quick to condemn this wonderful bird, but they should stop to realize that the great horned owl is an important link in the often mentioned but little understood "balance of nature." It is essential that certain birds and animals exist to keep others in check, to the end that one species may not increase beyond bounds and become a liability to the neighborhood, a detriment to other creatures and to plants as well, through sheer weight of numbers.

In the long run, the great horned owl does more good than harm and should not be killed indiscriminately where it has not been proved, beyond the shadow of a doubt, that his demise is necessary. The fact that an individual great horned owl may be observed killing chickens or young turkeys is no reason for killing all the owls wherever they may be found. The hand of man has been turned against these birds for so many years that it is a wonder any are left to grace the wilderness areas of our land.

In captivity the great horned owls, especially the ones caught as adults, are fairly uncompromising individuals. However, they have

➤ **Sound asleep** on his feet, after a hard day at the Trailside Museum. In his livelier moments, this little Screech Owl was an agile mouse-catcher

occasionally been tamed. We kept several with only a falcon's jess, or leash, upon the feet, instead of confining them to a cage. The large owls soon learned to accept this form of restriction and, as they sat upon their specially constructed perches under the deep shade of a tree, they seemed to be far more content than when behind wire. In fact, we soon learned that the birds did not particularly object to riding about on one's wrist. It should be added that the wrist was first protected by a heavy leather gauntlet for, if the large birds had decided to clamp down with their talons, the result would have been disastrous. Once a great horned owl closed his talons upon my own hand, and the scar will remain there always.

Many of the great horned owls that were brought to us had obviously had a passing acquaintance with skunks, and the evidence would remain with them for quite a time. No doubt, upon some quiet woodland path, a little black and white animal had met its aerial destroyer but had retaliated before giving up the struggle.

The great horned owl, when sufficiently provoked, will apparently tackle almost any foe. Recently captured individuals sometimes did their very best to strike us. I well remember one individual, a large bird with very dark plumage. He would wait until I had entered his enclosure and had shut the door before making a dive for my head. I could, of course, brush him off, but the battle always left me a bit shaky. The potential destruction embodied in those talons was not to be forgotten for a moment.

Our principal reason for keeping owls, and other birds and animals as well, was to enable thousands of visitors to familiarize themselves with them, in the hope that conservation, through knowledge and appreciation, might result. We thought it best never to have more than two specimens of any single animal or bird (we sometimes sympathized with Noah), yet at one time we possessed eighteen great horned owls. Nearly all had been brought to us by hunters who had first crippled them. We did considerable surgery and other repair work in order to save the birds, and released many in the confines of New York's Bear Mountain State Park where, supposedly, they would receive complete protection. Hunters were invariably horrified to learn of this, for the advertisements of ammunition manufacturers, plus old wives' tales, had convinced most of them that the birds should be completely exterminated. In fact, when they brought in specimens they were usually quite satisfied with themselves and were prone to take on the air of public benefactors. We disabused quite a few of this misconception. Several times we performed post-mortem operations upon dead owls and were able to prove to hunters that the stomachs of the despised birds contained mice and other rodents that the hunters agreed would do considerable damage if permitted to increase without check. It is always

◄ **The downy little screech owls** were great favorites—quite tame and relatively gentle satisfying to change a person's erroneous ideas when some wild creature is the beneficiary. We employed small owls as well as large ones in our missionary work.

The relatively diminutive Screech Owls in our collection always brought forth exclamations of appreciation from onlookers. These little birds, possessing a quavering voice, were kept indoors a good bit of the time and often became very tame. They were great favorites with those responsible for their welfare. One small bird, in particular, behaved almost like a kitten. Indeed his attractive soft head reminded one of an affectionate little cat's. This bird, Charlie by name, would perch upon one's finger with perfect confidence and ride about wherever one chose to walk, indoors or out. He would make querulous little sounds whenever his head was stroked and would sometimes work his way up one's arm until he sat upon a shoulder and pressed closely to his admirer's neck, where he would often go to sleep.

One day while being thus carried about, he chanced to open his eyes suddenly and spied a small dog that looked up at him inquiringly. Charlie was ready for battle instantly. His feathers fluffed up until he seemed twice his original size. His beak snapped with a noise that was doubtless supposed to be ominous, and he also uttered a hiss that sounded like steam escaping. Then, without warning, he suddenly raised one foot and grasped the ear of the boy who was carrying him. The result was startling. Charlie's talons were much smaller than those of the larger owls, but they were sharp and surprisingly strong. Before the surprised owl-bearer could move, he experienced an excruciating pain in the ear lobe, which caused him to jump into the air. But Charlie did not let go. In his excitement over the proximity of the dog, he simply held on to the ear for dear life, and we had to "pry" him loose. The sufferer found that, with a bit more pressure, he would have been able to wear an earring, for his lobe was nearly perforated. The activity amused everyone except Charlie and the boy, who learned just how sharp a screech owl's talons are!

The little bird fed well upon scraps of meat and showed great dexterity in capturing an occasional mouse. Like all others of his kind, he proved an interesting and desirable creature to have about.

Yes, we admired the owls and never failed to appreciate their ways, whether they were confined in cages or held in check on outdoor perches. But we prefer to have them free and in the open, and that, of course, is where they belong.

LET'S BUILD A SNOWHOUSE

Continued from page 465

find a use for them. Any outdoor man living within the cold areas of our country would increase his efficiency by mastering the few, simple principles required. Trappers, lumbermen, prospectors, engineers, bush pilots, game and park wardens, and commercial fishermen might at any time find a snowhouse convenient or necessary.

Sportsmen, commercial fishermen, and farmers who fish through the ice of the countless lakes scattered across our northern states and Canada would find the snowhouse invaluable. The hole through which the fish are caught can be made in warmth and comfort—after the house is erected. The experience of sitting snug and warm in a snowhouse while fishing through the ice is one that will delight both old and young.

Men who operate where winter accidents may occur should be snowhouse-builders, for winter accidents usually happen where houses are not available, and not infrequently the injured person would profit by treatment before being moved.

In the realm of outdoor sport snowhouse-building merits a popular reception. Winter sportsmen, campers, skiers, boy scouts, skaters, and pupils of country schools would add greatly to the zest and pleasure of their winter sports by the use of these "Eskimo bungalows." It is safe to forecast that within a few years this new winter activity will become a part of the training of Boy Scout troops throughout the northern states.

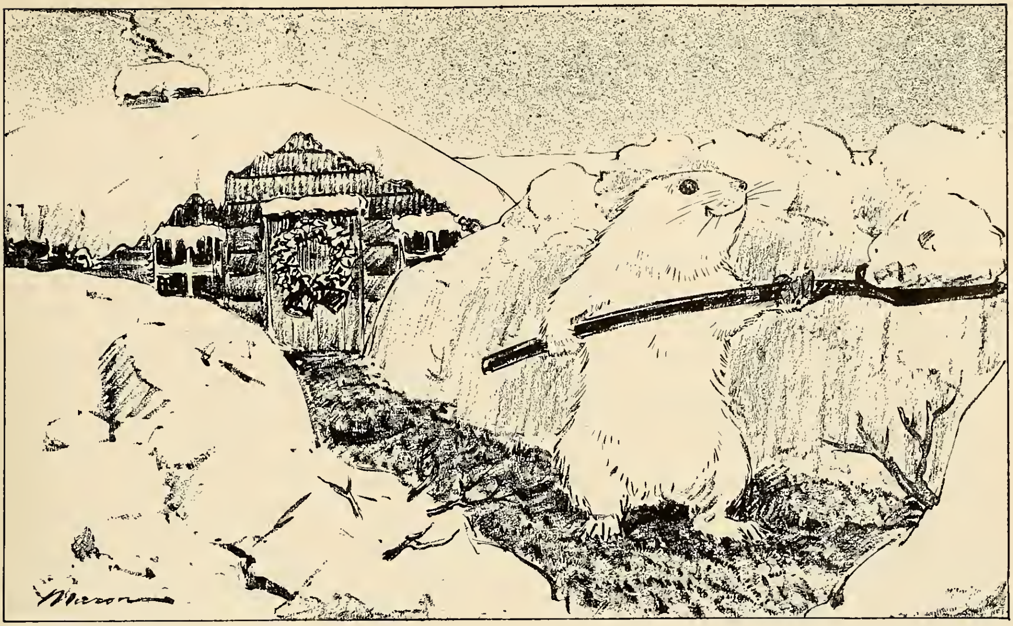
Speculation as to the origin of primitive procedures is a fascinating pastime. How did the Eskimo learn to adapt the principle of the spiral dome to the construction of a house completely of snow?

The discovery, while it may seem simple when you know the answer, probably required hundred of years of trial and error. Eskimos are constantly building snow walls for temporary shelters. With the increase of experience and skill in the use of snow blocks, some Eskimo genius must have noticed that when a curved wall was built around a depression, the end blocks could be sloped inward at a considerable angle from the perpendicular without falling. Such a wall would gain preference over the straight wall as it would furnish greater protection. The final triumph came when, seeking protection on all sides, the Eskimo hit upon the principle of the spiral dome and had a roof over his head as well. Imagine the joy and awe with which the first Eskimo family crawled through the door of the first snowhouse! Gone was the age-long terror of storm and cold; ended for ever, the horror of an animal existence during the polar winter.

After one night in a snowhouse of your own building, your traditional attitude toward snow and cold will change completely. You will stand shoulder to shoulder with the Eskimo and enter the realm of King Boreas with a joyful anticipation and confidence you never thought possible. The eyes of men are turning toward the North. The great fly-ways of the future lead across the great snow areas. It is time that we lost our fear of the magnificent land "up yonder" and prepared ourselves to play the part of men in the world's most healthful environment.

A vacation in Florida, imparting a he-man tan, may be relaxing, but the tan is only skin deep. A vacation in the northern snows will build you up from the inside out!

THE SNOW LEMMING



By John Eric Hill

Drawing by

G. Frederick Mason

FEW mammals live so near the North Pole as the chubby, short-tailed little rodent known as the varying lemming. Its name comes from the fact that it changes its grayish summer coat for a snowy white one when winter comes.

No land mammals except the polar bear and arctic fox go closer to the legendary home of the Christmas spirit. The varying lemming is found from northernmost Greenland and Ellesmere Land to the southern edge of the arctic tundra, and from Labrador to the River Ob in Siberia. Once, in the Ice Age or Pleistocene Period, the animal ranged as far south and west as Central France. Except for another kind of lemming, found in the New Siberian Islands, the snow lemming is the only true rodent that turns white.

A tawny marking across its throat in summer has caused this animal to be known also as the "collared lemming." Its summer coat is otherwise grayish, often clouded with black, with bright buffy sides and underparts washed with buff. Upon the approach of winter, the hairs of the summer coat fall out and in their place grow long white hairs with lead-colored bases. Both coats are much like those of the snowshoe rabbit.

In many ways, the collared lemming looks more like a miniature woodchuck than a mouse, having about the same build. Its ears are hidden in the fur, and its large eyes are placed near the top of the head. Snow lemmings measure five or six inches in length with a tail only half an inch long.

During summer they dig burrows underground with the long, sharp claws on their two middle fingers. But when the ground freezes solid each year, they can no longer do this, and a remarkable change takes place, fitting them for work in the snow. The claws grow larger and become doubled, one above the other on each of the two fingers. The upper part of the "snow claw," which sometimes becomes half an inch long, seems to be formed from the true claw. The second claw, below the true one and separated from it by a notch, apparently develops from the *subunguis,* which in man is the soft pad under the nail. The whole arrangement is well suited to digging in the snow.

In many places where these lemmings live, deep snow blankets the treeless plains from October to early May. For these little animals the snow is a great advantage. It keeps them warm and safe from predatory creatures while they forage beneath it for buds, grass, and the bark of bushes. When, as sometimes happens, strong winds sweep the flats clear of snow, great numbers of lemmings perish.

Underneath the snow, varying lemmings build nests of dry grass and musk-ox wool, nests a foot or more across. Here a whole family may live through the long arctic night, and before the snow melts in the returning sun, a new generation of four or five lemmings may be born. In good years breeding may continue through the summer, producing as many as five "blessed events." However, snow lemmings only rarely become abundant enough to migrate en masse like their cousins the famous migrating lemmings of Scandinavia, which were described in NATURAL HISTORY for April, 1945.

FISHING with Kite and Spider Web

One of the world's strangest methods of getting a square meal from the sea is practiced on Dobu Island, off the coast of New Guinea

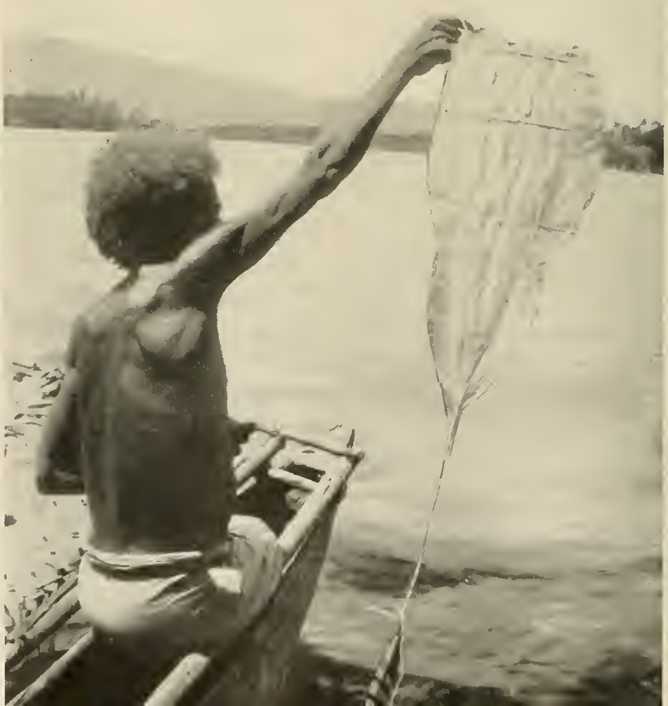
By Malcom Forbes[*]

Photographs by the author

ANTHROPOLOGISTS have long shown a great interest in the people of Dobu, and many books and articles have been written about these strange Melanesians. This island is but a dot on even a huge map of New Guinea, but the people themselves are known far and wide. They are a virile group, though very small in number. Not many years ago they were famous, or rather infamous, for the fact that they made fierce raids against villages as far as one hundred miles away, killing and capturing, and then escaping in their fast war canoes.

Anthropologists raced against time to record the strange customs of these people before the influences of civilization had completely changed their mode of life. Today there is little evidence that the Dobuans were once among the most vicious cannibals in the Pacific. However, they still occupy a prominent place in native culture. For one thing, their language is spoken or understood throughout the D'Entrecasteaux Islands. And there is one old custom that the Dobuans still practice to this day—kite-fishing. Somehow or other, writers on Dobuan society have nearly always passed off this unusual custom with a few words as though it were not at all peculiar.

While stationed at Milne Bay, on the southeast tip of New Guinea in 1944, I had opportunity to make several extended trips into the D'Entrecasteaux Islands, and it was



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[*] Malcolm Forbes, a newspaper editor who has studied anthropology at the University of Washington, spent a year and a half with the Army in New Guinea. This curious method of fishing by means of a kite was one of the native customs that he had opportunity to witness on several extended trips into the D'Entrecasteaux Islands.—Ed.

on one of these trips that I first saw the kite-fishermen. Sailing along the coast of Normanby Island in a pearling lugger one morning, I noticed a lone native in his outrigger canoe (*lakatoi*) about a mile offshore. He was flying a kite. In all innocence, I pointed out to the Aussie in charge of our boat that this native certainly had chosen a strange place to fly his kite. Suppressing a smile, the Aussie explained to me that the native was working, not playing, and that he was using one of the local methods of catching fish.

That evening at Salamo Mission, across from Dobu, I spoke of the kite-fisherman I'd seen. My host expressed the opinion that this strange method of fishing had probably originated on Dobu Island, but that the people on adjacent islands were taking it up. He suggested that I hike over to the next village and get some firsthand information from one of the native fishermen living there.

For a few sticks of trade tobacco I was able to examine one of the kites, talk to its owner, and see a demonstration. The kite is made of paper-thin, dried banana leaf and has four sections neatly sewn together with pandanus fiber threads. The cross-sticks are cane. The line to the kite, and from the kite to the water, is also made from pandanus fiber. This unbelievably strong twine is taken from the aerial roots of the pandanus palm and is the source of most of the material used in making fishlines, nets, and bags.

If kite-fishing itself is most unusual, what would you say about the bait the natives used? Spider web! The hand-size New Guinea spiders weave huge nets, and it is these nets that the natives use. They gather the webbing by means of a forked stick, rolling it into an elongated ball and fixing it at the end of their line. No hook is used.

It seems that only one type of fish is caught with this lure-bait: the gar. Playing his kite about fifty feet above the water, the native merely sits in his outrigger until he gets a strike. An occasional paddle stroke keeps his canoe in position. The kite, meanwhile, flutters above and in front of him. The line to the kite, and from the kite to the water, is a continuous one. The silvery, waterproof bait goes skipping lightly on top of the water, simulating the darting motions of a small flying fish, which is evidently what the garfish thinks it is going to get when it sinks its sharp teeth into the dancing ball of spider webbing. Once contact is made, few escape.

Just what prevents the fish from escaping seems to be a matter of much discussion among the natives, for they do not all agree that the fish, because of its mouthful of teeth, simply gets entangled and can't get away. Some natives assured me that the web sticks to the fish's mouth, sealing it, as well as getting entangled in its teeth. But one man went so far as to tell me that the web also poisoned the fish. When the strike is made, the fisherman pulls in his kite and line; or, if he is not alone, his companion will swim out and pick up the struggling fish.

While I have used the term "garfish," I only met one person who referred to it by that name. The natives have many names for it, but it evidently belongs to the garfish family. All the specimens I saw were about eighteen inches long, four or five inches in circumference, and weighed possibly two pounds. Other types of fish are perhaps also caught with this tackle, but so far as I could determine the kite-fishermen went out to catch this species and nothing else.

In talking with some of the old European residents afterward, I discovered that kite-fishing is not confined to the D'Entrecasteaux Islands but is practiced in other parts of the southwest Pacific as well. One of my informants, a former native-recruiter, stated that he frequently saw kite-fishing in the Solomon Islands and that the methods used were much the same as those of the Dobuans except that butterfly cocoons were also used as bait or lures. He furthermore thought that pandanus leaves were used instead of banana leaves and that the lines were bush-vines, not fiber.

Western civilization long ago introduced metal fishhooks into New Guinea, but the garfish-loving native clings to his ancient way of fishing with a kite. This probably seems a slow method of fishing, but as many as fifty fish a day are reported to have been caught by these fishermen. What is hard to understand is just why the natives want to catch this scrawny, almost inedible fish they call the Needlefish.

◂THE KITE is made of dried banana leaf, sewn together with pandanus fiber thread, and has a "pleated" palm leaf tail (*at bottom of photograph*)

➤LAUNCHING THE KITE. The bait, made of spider web, skips lightly on top of the water, like a small flying fish

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KIP

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eats well and revels in fresh milk and butter."

The next letter announced that Kip was as fearless with the big dogs as he had been with the baboons, so three of them were turned loose in the evenings to play with him. But the dachshund remained his special pal. Kip "flea'd" the pups by nibbling them all over, and when they were old enough, he loved to romp with them.

Being full of mischief, Kip deliberately set out to scare the pigs by running round the fence and growling at them through the rails, until they must have thought that a leopard, at least, was after them. Another of his pastimes was to wait till all the pigeons were on the ground, then charge among them. Indeed, he loved chasing everything but would hurt nothing. Even the chickens seemed aware of his harmlessness, for they paid him scant attention, whereas they went into hysterics at sight of a serval kitten. Though Kip showed a fondness for ratting in the store, he was never known to catch a rodent, and I very much doubt if he would really do so.

Naturally inquisitive, he liked to have his nose in everything and would wander all over the farm until 9.30 A.M. Then, becoming sleepy, he was quite willing to be shut up in his box. This he kept scrupulously clean, for Kip was as well behaved as any dog. When he wanted to be let out, he would ask by scratching at the door. So dog-like was Kip that eventually my correspondent ventured to take him on safaris far from home. Once he disappeared but, as a letter informed me, "he could find nobody in the bush to cook rice for him, and this must have been a great disappointment, for he likes to have his meals regular." So three days later a somewhat muddy and unkempt Kip trotted into camp and was very pleased with the reception party. However, the call of the wild proved too strong and Kip departed once too often, never to return.

CAN ANIMALS THINK?

Continued from page 480

fully picked up a six-inch twig from the ground and held it toward him. Stretching out his neck he sniffed it, and then he went back to his grass.

Moving very slowly, I reached over with the twig and gently touched him on the ear. Other than to twitch his head, he paid no attention. Then I scratched him a little just back of the jaw. That was his weak spot. He must have been itchy there for a long time, for he stretched out his neck and, with his eyes half-closed, enjoyed my scratching as much as any dog or cat ever did. After a few minutes I discarded the twig and offered my bare hand. He would allow me to reach him, but just as soon as my fingers touched his fur, he would rough up his tail in alarm.

Being too close to take chances, I didn't press our acquaintance. If I had only had the time and a few titbits in my pocket, I am sure I could have handled that skunk in a comparatively short time. What interested me most was the way he seemed to know that I meant no harm. Most wild animals are extremely shy of man and take a great deal of persuasion before they will allow any familiarities.

Of all the big game of the North American continent, the bighorn ram is considered by most hunters to be the most difficult to stalk. In the first place nature has given him a marvelous pair of eyes—eyes equal, I believe, to a man's aided with a fine pair of six-power glasses. Then, too, his native range,

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the high, rugged peaks of the Rockies, offer him protection on their craggy flanks, helping him to put distance between himself and his enemies. Mountain sheep are not only masters at making fools out of their enemies and finding a living in a country noted for its hardships, but they actually play organized games. The young of most animals enjoy a good frolic, but this play is usually just an aimless scuffling or scampering. The young and old of the mountain sheep family play organized games startlingly similar to those played by schoolboys.

One summer my partner, Bert Riggall, noted authority on wild life, was camped with a party of trout fishermen near the British Columbia border in southwestern Alberta. It was a warm evening in early July when Bert stepped out of his tent with his glasses for a look at the mountain face back of the camp. A quarter of a mile to the west the sheer cliffs of the Continental Divide rose three thousand feet to the sky line. Bert played his glasses back and forth over the mountain looking for game, and was not surprised to see a lone mountain sheep ewe standing silhouetted on the summit against the sky. In a few minutes the old ewe was joined by nine other sheep—all ewes, lambs, and small rams.

Directly under the sheep, a steep, hard snowdrift ran down a hundred yards to the top of the main cliff, which dropped off sheer, and overhanging hundreds of feet into airy space. To Bert's great surprise the old lead ewe suddenly stepped over the edge and shot down the snowdrift with her feet set, straight for the cliff below. Plowing down over the crust at high speed with the snow squirting up from her hoofs in showers, she seemed bent on suicide. When only a matter of feet from the lip of the cliff and a terrible plunge to a sure death, that astonishingly active old grandmother made a sort of four-legged Christi turn, and galloped merrily off the snow onto a dry, rocky rib to one side. Then she began climbing as fast as she could leg it to the summit. One after another the rest of the band followed her glis-

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sade, each making that hair-raising, nonchalant turn on the edge of disaster and climbing back for another turn. Down in camp the whole party sat breathless with glasses glued to their eyes watching every move of that daredevil game, played so expertly by those masters of the crags. The sheep went on with their play with no letup until it was too dark to see.

At another time, Bert and a party of mountain climbers watched for two hours while five young rams played "I'm the King of the Castle" on a small conical pile of loose rock left by a receding glacier. One ram would take his place on top of the mound and stand off repeated attacks by the other four, until he was disloged. Then the winner took his turn and so on.

One autumn we were out camera hunting with a party in sheep territory. Climbing up the side of a high dividing ridge one morning, we cautiously poked our eyebrows over the sky line to glass the basin beyond for game. In spite of a careful combing, we could see nothing, so we got to our feet and walked boldly out onto the summit and headed up the crest of the ridge toward another basin higher up. We had not gone 50 yards before Bert spotted a bunch of fine big rams. Bedded deep in a boulder field, they were so well camouflaged that we missed them completely on our first look. One thing was quite plain. They all had their eyes fastened on us as we stood outlined against the sky a thousand yards above them. There were five of us in the party, and we held a hurried council of war before moving on. We decided to continue on along the sky line as though we hadn't seen the rams, until we came to a huge boulder a couple of hundred yards farther up. There, while momentarily hidden, two of us would drop under the ridge to try a stalk for some pictures, while the other three continued on in plain sight to draw the ram's attention.

At first things went as we hoped. We arrived at the boulder, and while briefly screened, two of us doubled back, keeping out of sight. When Bert and the rest of the party stepped out into the open, the rams were still bedded down and apparently not alarmed. But they had not gone 50 yards, before the big sheep jumped up and hit the rocks running. When last seen they were stringing out over a pass a mile away and still going strong. I won't say that mountain sheep can count, but they acted as if they knew that three plus two makes five. This is a good example of the keen intelligence of the bighorn, and a good sample of what the sheep hunter is up against.

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Ever since I was able to walk, I have been observing animals, both wild and domestic. The longer I live, the more astonished I am at the limited scope of my knowledge of their ways. Although I have spent a good deal more time than most people watching them, I still see but a fraction of their lives. What are they doing in their dens and way up in the fastnesses of the peaks, where I cannot follow? Can they converse in languages of their own? These are some of the questions that puzzle me. Of one thing I am sure. For the most part they have keen brains and know how to use them. Give them a fair chance, and they will survive to be enjoyed by countless generations to come.

BOOKS

Continued from page 449

friendly, but more than that he was talkative. Evans became "awestruck at the immensity of his ignorance." The talkative wanderer was not only wrong about many things; he was so colorfully and, what is worse, so confidently wrong that he "seemed to be Rumor personified." Realizing that there were others as happily misinformed, Evans determined to dig deeper into the story of delusion and to make an attack upon the more preposterous errors and legends that mankind insists upon believing. Starting with the controversy over Adam's Navel and concluding with H. L. Mencken's vigorous hoax about the bathtub, Evans leads us through the intriguing, but painful corridors of man's credulity, including several chapters on unnatural history. Especially timely are the chapters that deal with misconceptions concerning race.

This book should arouse controversy, but it will stimulate those who are seriously interested in real freedom of thought. Some who read it will find good ammunition for interesting table-talk, but the author, despite the lightness of his style and the welcome air of good humor, indicates that this is an appeal to rational men to arm themselves mentally in the cause of common sense. Aware of the rarity of skepticism, which he calls the life spirit of science, the author calls for mankind to demand the credentials of all statements that claim to be facts.

This book is one well worth reading and one worth passing on to others to read. The author's concluding statement, in a far more serious tone than the bulk of the book, indicates his purpose, "For in the last analysis all tyranny rests on fraud, on getting someone to accept false assumptions and any man who for one moment abandons or suspends the questioning spirit has for that moment betrayed humanity." It probably does little harm to believe that bats are blind, that hair turns white overnight, and that orientals have slanting eyes. But who can calculate the harm that may result from an ignorance of zoology, physiology, or anthropology, or from forming an opinion without evidence?

John R. Saunders.

X-RAY SURVEY ON DUCKS

Airplanes and a portable X-ray machine will be used this year by Illinois Natural History Survey technicians in an intensified study of migratory waterfowl. The planes will take censuses of migratory ducks along the Illinois and Mississippi rivers and attempt to locate major feeding grounds. The X-ray, or fluoroscope, will be used to determine the percentage of wild ducks that carry lead shot in their gizzards or other parts of their bodies. Sportsmen and wildlife technicians know that lead poisoning among ducks and geese is not uncommon. The birds pick up lead shot while feeding in heavily hunted areas, and as a result some of them become ill and die. The portable fluoroscope is expected to throw light on this oft-disputed topic.

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